CEREAL SCIENCE *today*

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SEPTEMBER 1957 VOLUME 2 • NUMBER 7

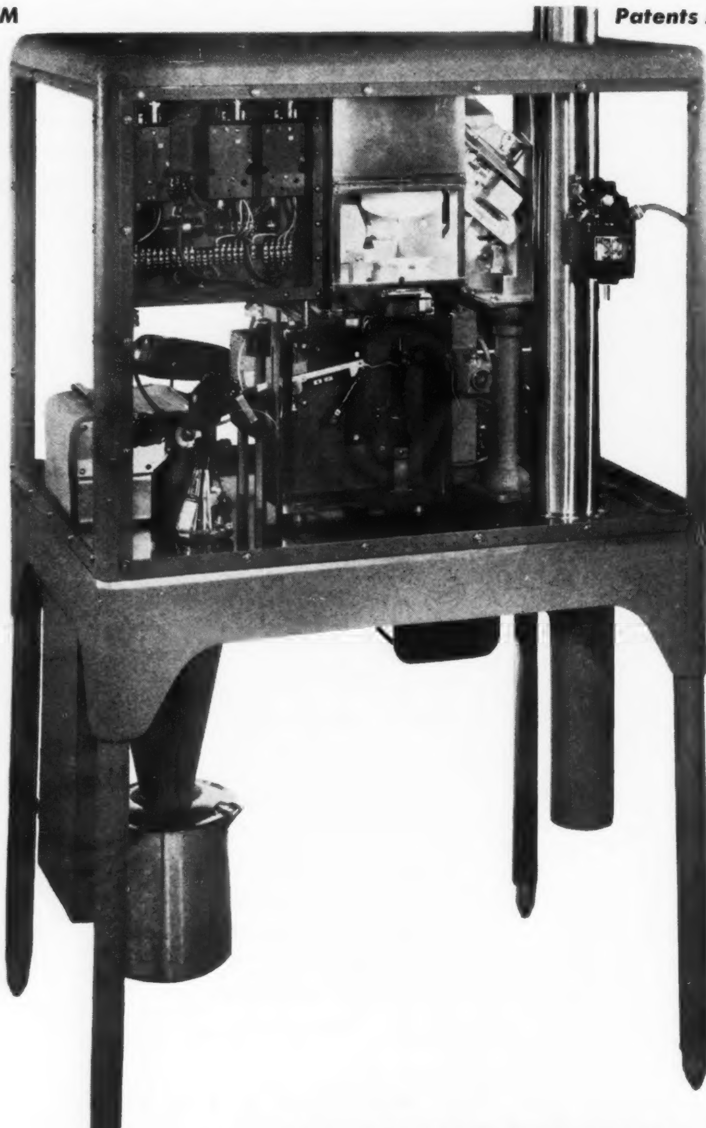
AN OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS

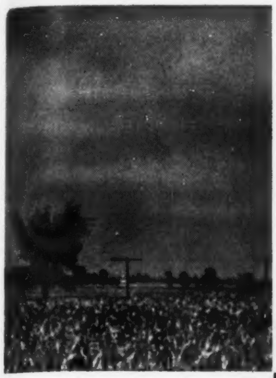
OF INTEREST THIS MONTH

BRITISH FLOUR MILLING TECHNOLOGY

THE BAKER CONTINUOUS DO-MAKER

SHORT-TERM BULK FLOUR STORAGE





VOLUME 2 • NUMBER 7 • SEPTEMBER 1957

CEREAL SCIENCE *today*

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TECHNICAL SECTION

DEPARTMENTS

STAFF

COVER: Harvest scene on a large farm in Western Canada, near Saskatoon, Saskatchewan (Photo courtesy National Film Board of Canada).

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LETTERS to the editor

STANDARD ACID FOR KJELDAHL

DEAR SIR:

The method given below is used in our laboratory for making up standard acid; perhaps your readers will find it useful.

The preparation of standard acid for the Kjeldahl method titration is slow and tedious because of temperature changes, variations in sulfuric acid strength, and errors of measuring volumes. Much of the difficulty can easily be prevented if the following method is used:

> To prepare 0.1*N* acid, dissolve 13.8 g. of analytical reagent grade sodium acid sulfate ($NaHSO_4 \cdot H_2O$) in distilled water, and dilute to exactly 1 liter. When thoroughly mixed, this acid solution will be found to be exactly 0.1000*N*.

Larger volumes, of course, can be prepared with equal convenience. We have used this acid salt as standard acid in the Kjeldahl method for more than a year, and find it to be most accurate and convenient to prepare.

The hydrated salt is stable and will not change during storage under average laboratory conditions.

WENDELL REEDER and JAMES PATTON

Campbell Taggart Research Corporation,
Dallas, Texas

LINEAR PROGRAMMING ADDENDUM

DEAR SIR:

Since the appearance of the article by Mr. Leon Findley entitled "Operations Research — An Aid to the Executive" in the January 1957 issue, we have received a number of inquiries concerning the example of linear programming given in the article.

The question has been raised as to what is the cheapest mix if there is no 1000-lb. limitation on ingredients. As this problem is of more general interest to most manufacturers, we thought that you might appreciate the following addendum which gives a method of setting up this problem and a solution. The solution arrived at is a hypothetical mix, not a recommended one. It does, however, have the feature that no mix, which is less costly, can be gotten if only the four listed ingredients are available.

The problem discussed was the determination of a dog food mix. The example concerns a company which has or can obtain 1000 lb. of each of four ingredients. It desires to mix a dog food *which optimizes its profits* using the available ingredients, subject to nutritional requirements. It is important to note that the formulation of the problem does not allow the company to go out in the open market and purchase more than 1000 lb. of any one ingredient. This limitation is imposed by the following equations:

$$
\begin{aligned}
Am + Xa &= 1000 && (1)\\
Bm + Xb &= 1000 && (2)\\
Cm + Xc &= 1000 && (3)\\
Dm + Xd &= 1000 && (4)\\
Am + Bm + Cm + Dm &= 4000 && (5)
\end{aligned}
$$

In effect, what is being said is: within the limitation of 1000 lb. of each ingredient, combine as much as possible of each, subject to the nutritional restrictions. The second restriction is that each pound of this mix must cost less than 40c so that a profit can be made.

The solution of the problem called for

$$
\left.\begin{array}{l}
\text{1000 lb. of ingredient A}\\
\text{536.8 lb. of ingredient B}\\
\text{1000 lb. of ingredient C}\\
\text{42.9 lb. of ingredient D}
\end{array}\right\}(X)
$$

This solution results in a cost of 9.12c per lb. and a profit of $796.61 which is a maximum for the given conditions.

However, another interesting problem is suggested by the first. Assume we have a manufacturer of dog food who can go out in the market and buy as much of any one of the ingredients as he desires. The only restrictions he faces are those imposed by the nutritional values and the profit equation.

To formulate this problem it is only necessary to change equation (5) to $Am + Bm + Cm + Dm = 1000$. Here we remove the restriction of having limited ingredients. In practice there is enough of any one of the four ingredients to meet the requirement of 1000 lb. of the dog food. The solution to this type of problem then gives the *minimum-cost mix*. Using the restrictions of the original problem and $Am + Bm + Cm + Dm = 1000$, one gets a solution of:

$$
\left.\begin{array}{l}
\text{714.285 lb. of C}\\
\text{285.715 lb. of D}
\end{array}\right\}(Y)
$$

which gives a cost of 4.286c per lb. as compared to the original solution having a cost of 9.12c per lb.

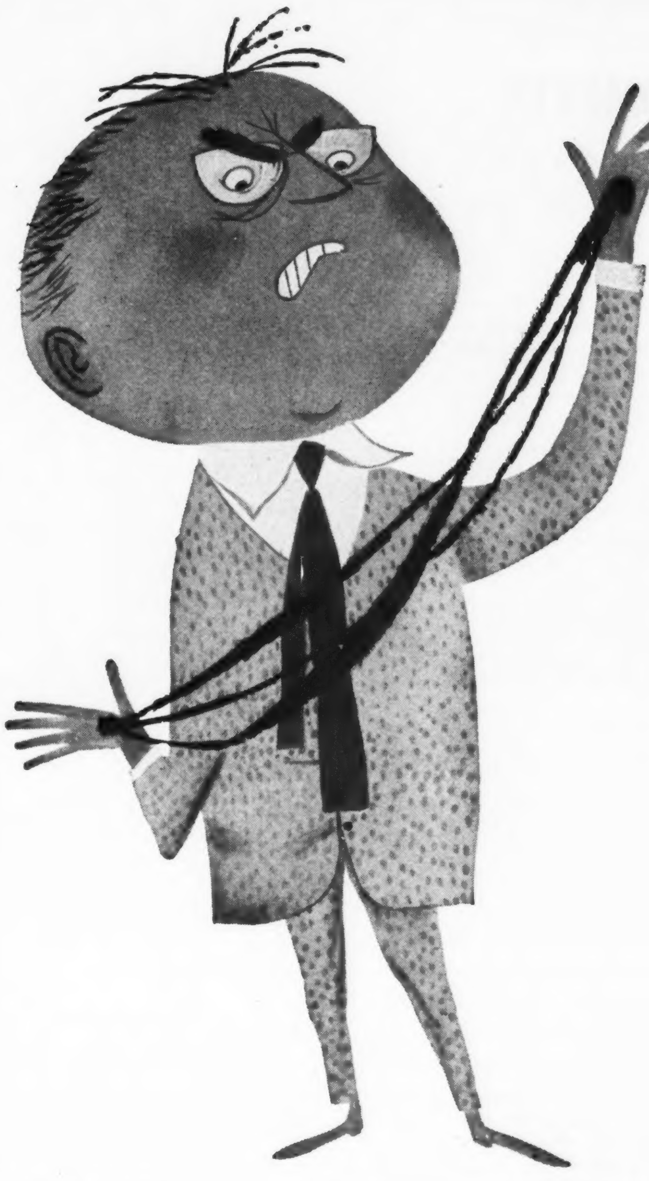
The majority of manufacturers are probably more interested in the second approach, for they want to produce the least costly mix subject to the nutritional requirements. Once they have the least costly mix they buy as much of each ingredient as required in the open market. Profit is maximized by selling as much as possible of the mix. For a given sales volume the manufacturer using mix Y will always make more profit than the one using mix X.

This points out a very important feature of Linear Programming problems. That is, great care must be taken in the formulation of the problem to ensure that we are really solving the problem in which we are interested.

It should be noted that mix Y is a liquid diet, as only water and dry skimmilk are used. It is possible to use as an ingredient some fish product having a high moisture content, solid state, and low price, to ensure a solid food. Also, fat, vitamin, and roughage contents may be restricted. But problems with these additional restrictions and added ingredients would require the use of electronic computers owing to the amount of calculation required.

LEON FINDLEY and AARON GLICKSTEIN

Operations Research Section,
Midwest Research Institute,
Kansas City, Missouri



Editorial

Communication with one's colleagues is accepted by most scientists as being not only desirable but an obligation. Without communication, scientific research would slow down to a snail's pace. Many of our most important discoveries might still lie dormant. The Salk vaccine is but one example of hundreds we could name. But along with this obligation to communicate with one's peers is an ever greater one — that of communicating with the man next door.

Unfortunately for the scientist, the average citizen isn't interested in every investigation or even in the details of some. Mr. Citizen is concerned with what will affect him in everyday life, with the applied aspects only. Now many of us might say "So what?" and let it end there. But if we think about it for a moment, we'll realize that Mr. Citizen is paying the bill, either directly or indirectly, as a taxpayer or a stockholder. In 1957 the government will spend approximately 2.7 billion dollars for its scientific research program. In addition, industry expects to spend about 5.5 billion dollars. It seems logical to us that the scientist is not only obligated to let the public know "what cooks," but would benefit greatly by such discourse. While a great many government- and industry-sponsored research programs must remain classified, there are many projects that can be discussed freely. The latter are most often under the auspices of a university, and thus the academic researcher perhaps carries more than his share of the burden.

However, the world is becoming increasingly complicated and increasingly populated. And with greater populations and higher civilization comes the need for even larger research programs. We must keep our financial "angels" informed of our progress, convinced of its necessity, and enthusiastic about the potential outcome. We must keep the public on our side, not only anxious to share in the benefits of research, but eager to jump the next hurdle with us. Only in this way shall we be assured of continued support — moral as well as financial. We need this kind of support if we are to help make the world a place where man can at least influence if not control his environment.

R. J. Tarleton

RECENT ADVANCES IN

British Flour Milling Technology

By David G. Elias and R. A. Scott*

SINCE THE OUTBREAK of war in 1939, British flour-milling technology has been largely conditioned by various Government regulations and requirements which have had to be met over the years. Prior to the war, a straight-run flour of approximately 72% extraction was common (this being calculated on commercial or elevator wheat), though many patent flours of 20 to 40% extraction were produced. In early 1942, because of tremendous shipping losses in the North Atlantic, the extraction rate was raised to 85% and remained there until January 1945, when it was lowered to 82.5%. In the next five years, with the adverse balance-of-payments position restricting imports of wheat, the extraction rate was again mainly 85% except for a short period at 90%. Then in late 1950 the rate was lowered to 80% and this held for three years, until August 1953. At this time the industry was partially decontrolled and once again allowed to produce patent flours; provided, however, that these contained certain minimum quantities of token nutrients, and that the mills produced a flour equivalent to an 80% extraction. This latter flour, when baked into bread, qualified for a Government subsidy and thus the loaves sold for considerably less than loaves made from the patent flour, which in consequence had a restricted sale.

But the public demanded a whiter loaf; the bakers demanded a whiter flour; and confusion arose over the near impossibility of defining specifically a flour equivalent to 80% extraction. As a result, the extraction rate was gradually but significantly lowered by the majority of flour mills. In late 1956 after publication of the McCance and Widdowson Report (9) and the submissions of the Cohen Committee (10), the milling industry was freed from all Government control. Since that time, the average extraction rate has been similar to that in effect prior to 1939; that is, 72%. Again, however, certain nutritional requirements had to be met, and these are to be discussed later in this paper.

The grists from which flour is milled in England normally are mixtures of many types of wheat, the exact composition varying widely according to price, availability, and condition of the various ingredients. At the present time as little English wheat as possible is being used in the grists for bread flour, because the 1956 crop was fairly heavily contaminated with fungal spores which caused considerable darkening of the flour milled therefrom (1). Even where English wheat alone is normally milled, for biscuit (cracker and cookie) flours, it has been found necessary in certain cases to supplement the grist with imported soft wheats in order to preserve a satisfactory flour color.

Another point of note has been the combining of many plant bakeries into a small number of large groups and the gradual disappearance of the small baker, a process which is still continuing. As some of these bakery groups are controlled by large milling firms, the bread flour market of the small independent miller is no longer assured. Thus the majority of these millers have turned much of their attention to the manufacture of flours for special purposes such as household, self-rising, biscuit, and cake flours.

There is no doubt, however, that at least one beneficial effect came from the wartime and postwar control of the flour milling industry. As the wheat mixture, rate of extraction, and selling price of the product were all standardized, competition could only be on quality alone. Thus many millers gave much thought, time, and experiment to the production of their flours, and in consequence the high-extraction flours, which had started their existence as little more than ground meals, steadily improved. Some of the later 80% flours would stand comparison with many prewar flours of much lower extraction.

Flour Treatment

The treatment of flour to produce a product suitable for the consumer has long been the rule, rather than the exception, in England.

For many years nitrogen trichloride (Agene) was used for this purpose, both alone and in company with other agents, but its use was discontinued some time ago after the controversy initiated by Mellanby and the subsequent change of U. S. Government regulations. At present chlorine dioxide (Dyox) is largely used; in addition to this gas many millers use benzoyl peroxide and potassium bromate (or ammonium persulfate). The effects of these additives are carefully controlled by the use of suitable dough-strength testing devices and by estimating the residual coloration of flours with a simple extraction test.

For biscuit flours in which a softening action is occasionally required, even with English wheat flours, suitable processing may be carried out with a steam-sulfur dioxide mixture

* Henry Simon, Ltd., Cheadle Heath, Stockport, Cheshire, England.

which gives readily controllable (if somewhat evanescent) results.

Enzyme preparations have also come to the fore recently as tools for flour treatment, and both amylolytic and proteolytic enzymes are now available. As yet these products have not been produced commercially in a sufficiently pure state to warrant serious consideration, and thus the industry generally still uses malt flours where increased gassing power is required. There is little doubt, however, that efforts of the enzyme preparation manufacturers to render their products more specific and selective in their action will bear fruit in time.

Nutritional Additives

At present all flours (other than whole-meal) must comply with Government specifications as to minimum levels of certain nutrients (2) — vitamin B_1, nicotinic acid, iron, and calcium carbonate. The first three of these are normally added in the form of a single premix, using a dried flour carrier, and little difficulty has ensued from their use. The assay of thiamine by normal fluorimetric methods is the yardstick generally used in adding all these substances, the users relying on the manufacturer's correct proportioning of the other ingredients.

Calcium carbonate in the form of *creta preparata* must also be added to most flours. This has taken a wry twist. Originally added to counteract the influence of phytic acid in high-extraction flours, *creta* was retained in the present low-extraction flours to counteract a possibile calcium deficiency in the general national diet. At the same time, a small but vocal section of the community insisted on being able to purchase the so-called "natural wheat flours" —whole-meal, stone-ground flours containing no additives or processing agents of any type. In consequence a miller must now add *creta* to all flours other than the flour which in the original instance required it most! Also Britain must export *creta preparata* to Canada and other countries, to be incorporated in flours destined for sale in Britain — so that we are now buying back the "white cliffs of Dover" at a premium hard-currency rate! This is perhaps a fair example of the anomalies that may arise in the bureaucratic control of a technological process.

Laboratory Testing

Along with the general technical development of the flour milling process since the war there has grown also the necessity for accurate process control, and the mill laboratory has become the rule rather than the exception. Many tests performed are indentical with those familiar to cereal chemists the world over and therefore need no description here. However, in two main respects British laboratory practice differs from that of the United States.

The first of these is dough strength testing. In Britain the data gained from load-extension tests on doughs prepared under certain controlled conditions are regarded as of greater general value than data on dough mixing characteristics alone, though the latter still find favor in certain bakery circles. With the "Research" Extensometer, the Brabender Extensograph[1], and to a lesser degree the Chopin Alveograph, fairly accurate control of heat treatment or processing agent treatment has been achieved. The "Research" equipment is used in conjunction with a simple whole-meal grinder to give a satisfactory wheat sorting test, particularly in the selection of soft English wheats for biscuit flour purposes (3).

The second difference is in the grading of flour and mill stocks. The ash test was never regarded very highly as a purity test in the United Kingdom and with the compulsory addition of calcium salts to the flours it became almost useless. The Kent-Jones and Martin flour color grader therefore filled a long-felt need in the industry and rapidly superseded most other forms of mill quality control. A new version of this instrument (4, 8), embodying a number of desirable modifications worked out as a result of the field experience with the initial design, has now been marketed for some time and most U. K. mills and mills in many other countries are equipped with this instrument. For speed and ease of operation the test can hardly be compared with the tedious and time-consuming ash and fiber tests, and modified versions of the equipment have been used for checking individual machine performance in the mill (11). Such has been the success of this device that plans are now well advanced for a continuous model which may well find a place in the control equipment of the automatic mill of the future.

[1] Registered trademark by Brabender Corp., Rochelle Park, N.J.

Machine Development

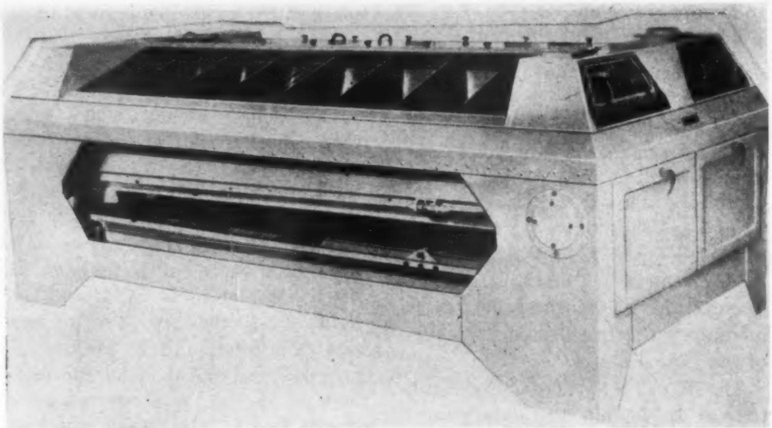
Here many changes have taken place since the war. Perhaps the most obvious is in the now almost universal use of metal in place of wood for the main constructions. Several factors contributed to this change: The general advance in techniques for metal fabrication in mild steel and light alloys, the need for interiors free of infestation-prone pockets and crevices, and the demand for economy of space. The screenroom machines, first to take on this new look, have been followed steadily by the main flour milling process machines. Notable among the latter has been the all-metal purifier, and in particular the "low-head" type of purifier. This machine contains many innovations, but particularly provides properly controlled distribution of air flow through the sieve without the necessity of using steep-sided hoods, and can thus be made compact enough to stack two-high (see illustration). This attention to air flow and to general conveying mechanism has led to greatly improved purifying action in an elegant, accessible, and hygienic machine which exemplifies the present tendency toward space-saving, high-capacity plant requiring minimum supervision.

The general trend toward metal can also be traced as a natural accompaniment of the pneumatic conveying of mill stocks, and is shown specifically in metal spouting with its smooth, standardized bends and couplings.

In process changes, apart from the now well-known replacement of mechanical by pneumatic conveying and associated redesign of machinery, there is also a trend toward bulk delivery of products and full mechanization of the packing process. This latter has been particularly important in small bag packing plants working on day-shift only, where considerable economic gain is realized.

Conditioning

Conditioning of the wheat grist prior to milling has always been regarded as a matter of the greatest importance in Britain. Few millers would even consider commencing their process without having at least attempted to obtain a desirable distribution of moisture within the



Simon Type "S" Purifiers, shown stacked two-high.

grain. There are many individual idiosyncracies, of course, but in general it can be stated that the millers in Scotland (who use a strong wheat grist) lean toward the cold-conditioning system, which may require as much as 100 hours of bin lying time; whereas English millers (whose grist contains much softer wheat) tend to use heat and thus reduce bin time to 24 hours or less. Much basic work on the rate and route of moisture absorption has been done recently, and it may well affect the design of future conditioning processes. Perhaps the most interesting studies have been those on the effect of increasing temperature of wheat undergoing break-roll treatment (12). Much of this information has already been published, and thus the process details will not be covered here. In brief, it is found that if wheats, and in particular hard wheats, are fed to the first break roll at 38°–40°C. instead of the normal 18°–22°C., then certain desirable effects are produced: the bran particles are larger and less torn, and the endosperm is rendered softer and more plastic.

In short, the heating of the hard wheat produced effects which gave it some of the desirable milling characteristics of the softer wheats. As mentioned in one of the papers on the subject (7), "the effects of milling cold and warm wheat respectively, may be said to resemble the effects of hammering a paper bag when stretched round a flint and when stretched round a lump of chalk. Far more damage will be done to the envelope in the former case than in the latter before the contents are broken down to a similar extent in both cases."

There are, of course, many factors in a normal commercial milling process which may affect the straight-run flour relative to the performance of the break rolls. A flour of better quality is not necessarily produced in general practice as a direct consequence of a single change in the process such as is envisaged here. Nevertheless, it is probable that the warm wheat milling work will focus a good deal more attention on conditioning processes in general and on break roll stock temperatures in particular in the future, especially in fully pneumatic mills where any loss of sifting efficiency may be obviated.

Protein Concentration

Perhaps the most recent and possibly among the most important developments in milling technology have been those concerned with the application of impact milling and air classification processes to various flours and mill stocks. In themselves these are by no means new processes, of course, and in our own laboratories we have for many years been studying the effects of both types of action on a number of materials. The early papers of Professor Hess (6) in Germany on the location and formation of the protein and starch elements in wheat endosperm elucidated much of the background for these operations, and the work of Hansen and Niemann (5) in 1955 and earlier indicated certain practical aspects of the problem.

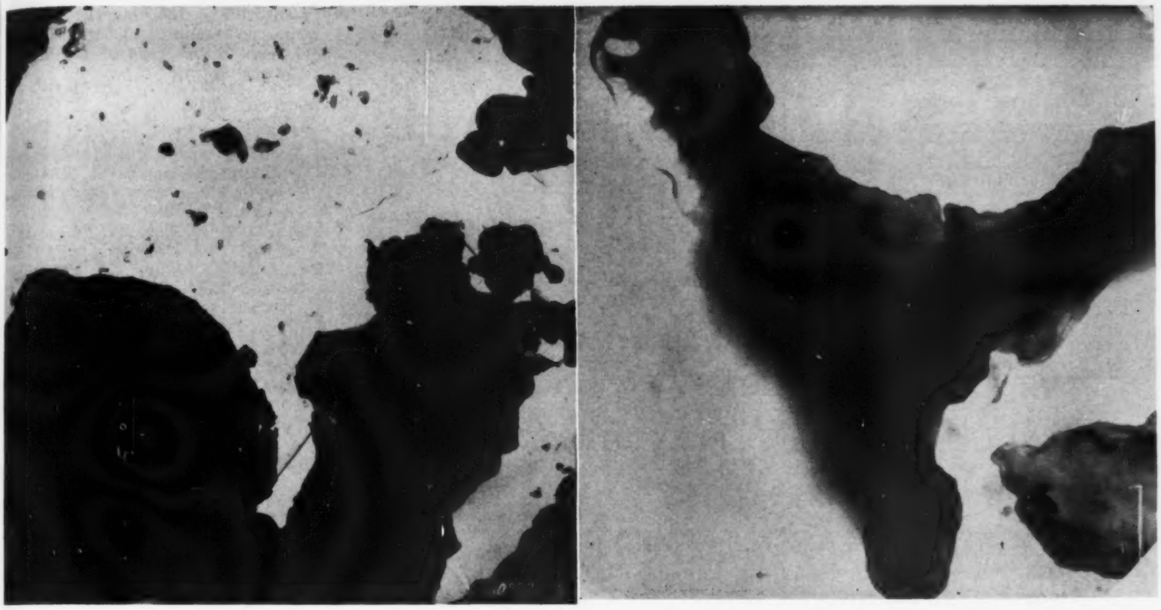
As is well known, the endosperm of wheat consists of a number of cells having a thin cellulose wall and filled with a proteinaceous matrix in which are embedded numerous starch granules of varying size. These endosperm cells vary in size and shape according to their location in the grain, as also does the size distribution of the starch granules within them—a variation which is responsible for the well-known differences in protein content between outer and inner endosperm. In flour milled from hard wheats, the endosperm cells tend to persist as such throughout the milling process, whereas in soft-wheat flours the cells break easily, spilling out their contents in irregular agglomerates. Thus under normal conditions a hard-wheat flour has a gritty feel whereas a soft-wheat flour is mealy. These characteristics can, of course, be altered by suitable conditioning, as indicated earlier in this paper.

With both types of flour some free starch and a little of the protein matrix (broken down to small size by the normal process) will exist. To determine the relative shapes and sizes of these particles, they were studied with the aid of the electron microscope and some of the results are shown in two photomicrographs. In the first of these a small starch granule having a diameter of 2.5 μ can be seen with its associated portion of the matrix. The second shows clearly a typical piece of the material which has been termed "wedge" or interstitial protein.

The size and structure of these particles indicate clearly that if a size separation can be made at a certain point, the very small starch granules and the broken portions of the protein matrix will be found in the "fines" fraction, whereas the agglomerated material and the larger free starch granules will be found in the coarse fraction. This should result in displacement of the protein content. The cut size required is well below that obtained by normal sifting methods, of course, but a suitable machine for this purpose is the centrifugal air classifier in which air-drag forces can be counterbalanced by high centrifugal fields to give terminal velocity separations at much smaller sizes than was hitherto possible.

A laboratory instrument of this type is the Bahco Elutriator[2]. By feeding a normally milled soft wheat flour of 72% extraction and 10% protein content into this machine and setting the nominal cut size to 15 μ, two fractions could be produced: a) about 3% yield of "fines" having a

[2] Available from Establissements Neu, Lille, France.



Electron microscope photographs. Left, small starch grain with the associated portion of protein matrix. The starch grain is 2.5 microns in diameter. Right, typical portion of interstitial protein; approximately 6 microns top to bottom, before 40% reduction (approx.).

protein content of 18%, and b) 97% yield of coarse material having a protein content of 9.7%.

This amount of protein displacement is highly significant, but the yield is extremely small. However, further study of the relative friabilities of the starch and protein phases in the endosperm aggregates led to the development of a specialized impact grinding technique. After treatment of this type the same soft-wheat flour, when separated in the Bahco Elutriator, gave a greatly increased yield of the high-protein component. It was also found that by separating a flour at two cut sizes — say 15 μ (nominal) and 30 μ (normal) — the "middle cut" fraction contained a preponderance of starch granules and thus embodied a low protein content.

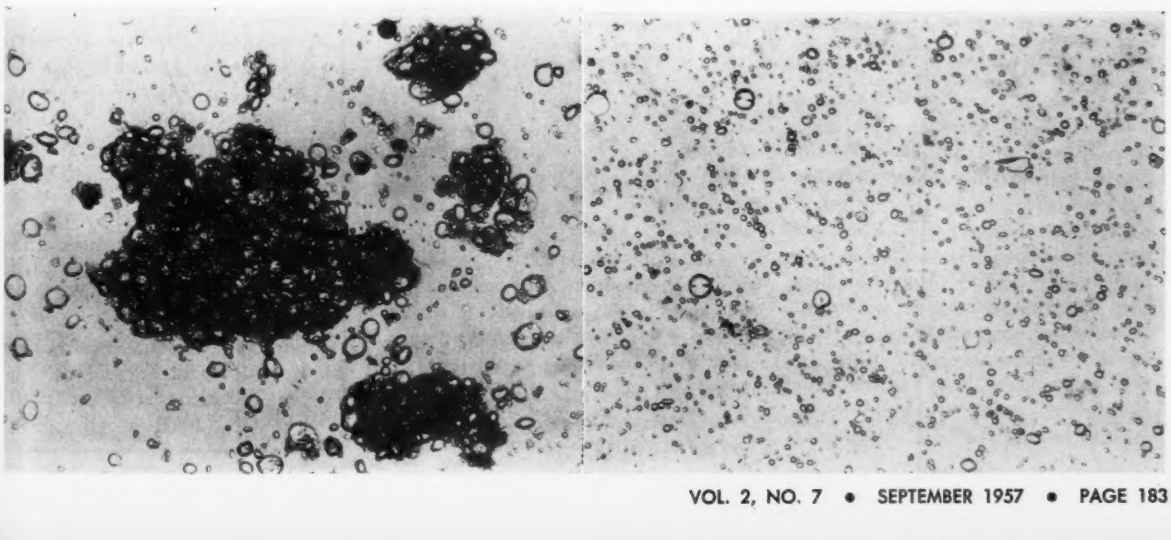
Translating laboratory experiments into a commercial scale is never an easy task, but it has proved possible to produce, on a reasonably large scale, products of the type shown in the diagram (page 184) from typical wheat flours. Photomicrographs of the soft flour used in one of these instances, together with the "fines" isolated therefrom, are also shown below.

It cannot be too strongly emphasized at this point that the results obtained in a process of this type depend largely on the basic properties of the original material. The figures given above, though reasonably typical for wheat flours milled in Britain, could vary widely in terms of yield and protein content according to the variety and condition of the wheat, the particle size distribution, and the grinding characteristics of the flour used.

With hard-wheat flours, the protein displacement has not been so remarkable as with soft-wheat flours, but is nevertheless significant, though much work remains to be done with pretreatment of this material. The author's work has been mainly confined to the soft wheat flours, as these are obviously of major importance in Europe.

It might be thought that the high-protein fraction obtained from a soft-wheat flour would not be of suitable

Photomicrographs of typical soft-wheat flour. At left, containing large aggregates and some free starch granules and small broken matrix material. Right, a typical fines separation from the flour in the above photomicrograph. The largest particle shown has a diameter of 25 microns.



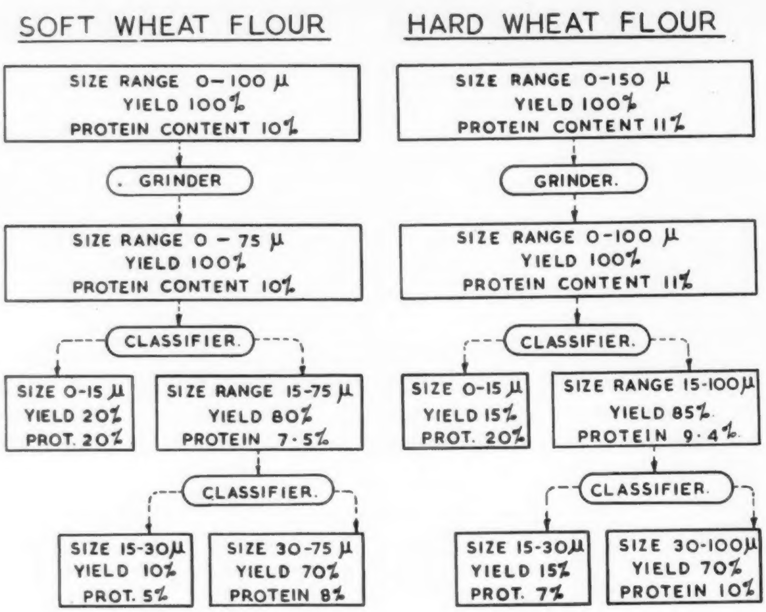


Diagram showing typical separation achieved by the grinding and classifying operations described on soft- and hard-wheat flours.

quality for breadmaking. However, tests carried out both by the authors and by the milling industry and the baking industry research associations indicate that good use can be made of this material as a fortifying agent. This point is illustrated by the loaves shown herewith.

It will be obvious that as yet the application of these new methods to the flour-milling industry is in its infancy. Even so, it is not difficult to visualize the future implications of such systems, particularly in countries where hard wheats can only be imported with considerable economic

Loaves baked from a soft-wheat flour with various additions of a high-protein fraction isolated from the same flour. Flour proportions of soft wheat (SW) to high-protein fraction (HPF): bread A, 100% SW; bread B, 90% SW, 10% HPF; bread C, 80 and 20%; bread D, 60 and 40%; bread E, 100% HPF. Protein content, respectively: 8.5, 9.75, 11.0, 13.5, and 21.0%. (All flours treated with 20 p.p.m. potassium bromate.)

The low-protein or "middle cut" fraction may well fulfill the requirements for specialty cake flours—a market which has not yet reached in Europe the importance which it enjoys in the United States. The medium proteins or "coarse fraction" may have a specialized value in biscuit manufacture, particularly in view of recent work on the relationship betwen percentage "fines" in the flour and the amount of "checking" in the finished biscuit.

difficulty, or where enough soft-wheat production capacity exists to meet, after suitable processing, at least part of the bread flour requirement.

The value of the extra flexibility which this system confers, together with the partial independence of the characteristics of the wheat mixture used, need hardly be stressed.

Our acknowledgments and thanks are due to the Metropolitan-Vickers Electrical Co. Ltd. for the electron microscope facilities, and to the Board of Henry Simon Limited for permission to publish this paper.

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CALENDAR OF MEETINGS

30th International Congress of Industrial Chemistry. Society of Industrial Chemistry and Union of Greek Chemists. Athens, Greece. Sept. 25-Oct. 2.

American Oil Chemists' Society. Netherland Plaza Hotel, Cincinnati, Ohio. Sept. 30-Oct. 2.

Association of Official Agricultural Chemists. Annual Meeting. Shoreham Hotel, Washington, D. C. Oct. 14-16.

Association of American Feed Control Officials. Annual Meeting. Shoreham Hotel, Washington, D. C. Oct. 15-17.

American Society for Quality Control. New England Sections. 11th annual Conference. Stratfield Hotel, Bridgeport, Conn. Oct. 16-18.

Society of Chemical Industry. Chemical Industry Award Dinner. Waldorf-Astoria Hotel, New York, N. Y. Oct. 18.

American Institute of Chemical Engineers. Annual Meeting. Conrad Hilton Hotel, Chicago, Ill. Dec. 8-11.

American Society of Agricultural Engineers. Winter Meeting. Edgewater Beach Hotel, Chicago, Ill. Dec. 16-18.

American Association for the Advancement of Science. National Meeting. Indianapolis, Ind. Dec. 26-31.

UP-TO-THE-MINUTE REPORT ON THE

John C. Baker Continuous Do-Maker

By Hugh K. Parker*

"THE MISSING LINK is an automatic bakery" — an installation that replaces sponge and dough mixers, fermentation room, sponge and dough troughs, divider, rounder, overhead proofer, molder and panner: that is the J. C. Baker Do-Maker Process.

First announced to the milling and baking trades about 5 years ago, the equipment and process have been discussed in various articles and press releases. To review and bring these discussions up to date is the present object.

The first authentic technical description of the Do-Maker and its process was given by J. C. Baker in a paper before the Bakery Engineers on March 1, 1954, although an announcement had been made by W. J. Orchard at the Millers' National Federation meeting on May 11, 1953. A paper by M. T. Tiernan (read by F. H. Watkins, Jr.) at the Bakery Engineers' meeting on March 3, 1957, was the most recent report. These two papers are landmarks of progress, Dr. Baker's expressing hopes and expectations, and Mr. Tiernan's reporting a realized accomplishment of about one million pounds of Do-Maker bread being produced per week. Besides the seven units built in starting operations, Mr. Tiernan stated, some 15 more were being made and still more were on order.

Flexibility of the equipment is revealed in its operation on either one floor or two floors, in established bakeries as well as in new bakeries built especially for Do-Maker operation. The present machine capacity limits are from 40 one-pound loaves to 85 one-pound or equivalent loaves per minute, and this production of course can be doubled with dual installations of equipment.

Although the Do-Maker costs $90,000 and a unit completely installed may cost as much as $130,000, these figures are probably less than the cost of new conventional equipment installed in a new bakery. Moreover, savings are considerable, as shown by calculations at three bakeries. At bakery A, savings per 100 pounds of baked product: labor, 8 cents; accessory ingredients, 6 cents; and formula ingredients, 17 cents, totaling 31 cents. At bakery B the comparable figure was 33 cents. Bakery C reported a much higher cost reduction, 96 cents per 100 pounds; here the continuous mix system helped to introduce economy and efficiency measures throughout the entire operation of the plant. At such savings and with other advantages such as the use of less floor space, any bakery producing 80,000 to 100,000 pounds of white bread per week should be interested.

Still another and important advantage is uniformity of production, operation, and product. Minute after minute, hour after hour, and day after day the Do-Maker will produce bread of the finest grain and texture on the market today, with slices of identical character from end to end. Thus this bread is a new product. The bakery owner likes it, the bakery operator likes to make it, and, as surveys show, Mrs. Housewife likes to buy it for herself and her family. The news has spread overseas; in England a unit is already in operation and some 20 more units are on order. With the somewhat different flour and lean formulas in use there, the Do-Maker came up to all expectations in the preparation of British-type bread.

Equipment and Process

The accompanying artist's conception of a two-floor installation (next page) gives a better idea of the equipment than is possible in photographs.[1]

Some changes have been made since the original seven units were built, but these have to do with improvement and simplification and do not affect the basic operation. Originally a part of the sugar, parts of the salt, and all of the milk were fed in the dry state into the premixer; these ingredients now are all added to the broth at make-up time, thus dispensing with three dry feeders — or making them available for other dry ingredients for variety bread or in special broths.

Operating Advantages

A distinct operational advantage of the Do-Maker process as compared to the conventional process is a saving in labor. In one installation, one man at the control panel and one man in the broth make-up room turn out 3360 pounds of bread per hour using the Do-Maker, as compared to four men producing the same amount of bread with conventional equipment. For clean-up, 3½ man-hours are required.

Operators are given initial training on the job and continue to train themselves and to improve their technique. Seeing the new process and its operation as a challenge, they rise to the occasion, soon learn the new art, and are proud of their progress. An alert operator sees differ-

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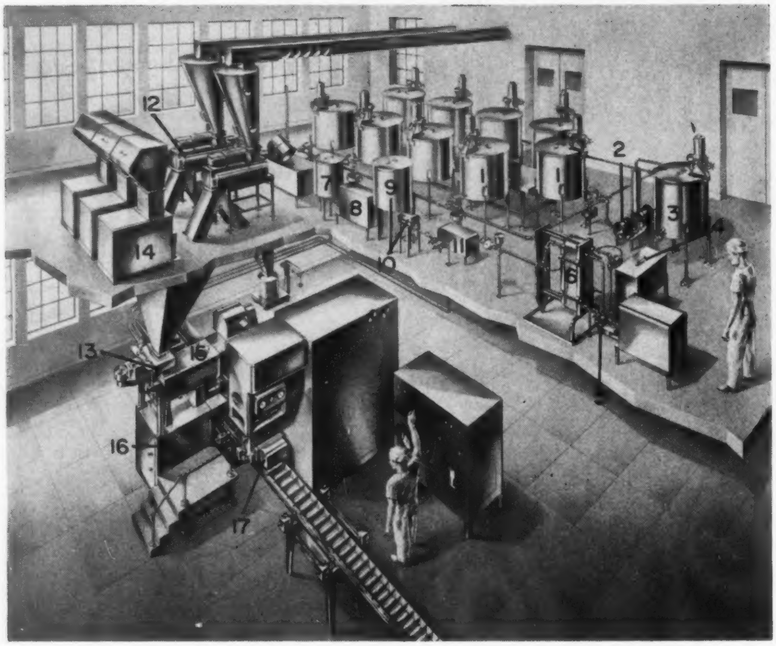
[1] A more detailed description of the apparatus and process, as installed at the plant of Purity Baking Co., Decatur, Ill., is in *Food Engineering 28:* 98-101 (Oct. 1956).



Flow description of the Do-Maker Process. Broths are set in tanks (1) where they ferment for about 2½ hours. When a broth is ready it is transferred by means of pump (2) to a broth transfer tank (3), from which it flows to a constant-level tank (4), providing a constant head on broth pump (5). From (5) the broth is metered through a heat transfer unit or broth cooler (6) to the premixer (15). Shortening mixture is usually premelted and delivered into a heated tank (7) which holds it in a liquid state and from which it is metered by pump (8) to the premixer (15). Oxidation solution is mixed and held in oxidation tank (9) and flows by gravity to its adjacent constant-level tank (10), from which it is metered by pump (11) to premixer (15). Flour feeders (12) meter the flour directly into the premixer. A sifter (13) screens out any foreign material. Other dry ingredients which are used for variety and specialty breads are metered into premixer from the dry ingredient feeders (14). All the salt, sugar, and dry milk are added directly to the broth tanks (1). All of the ingredients are combined into a dough in the premixer (15), carried forward to dough pump, and metered by this pump to the developer bowl (16). Developed dough flows from the developer through the extruder and divider (17), from which the dough pieces drop into the pans. Pan movement is synchronized with divider operation. (Picture and description are from **Food Processing,** Oct. 1955, and used with the permission of that Journal.

ences in the dough, notes power changes in his equipment, and makes the necessary adjustments. Flour temperature differences are compensated for by the broth heat exchanger.

Whereas sponges in a conventional bakery often are a total loss in case of oven breakdown or power failure, in the Do-Maker procedure only the broths in the preparation stage would be lost; the flour, which is the most expensive ingredient, would be saved. It is even possible to recover some of the broths if the stoppage is brief, by blending the youngest broths at the time of the accident with a freshly prepared mixture.

Do-Maker control includes ease of scaling weight adjustment and change from 1-pound to 20-ounce or 1½-pound loaves. Once the proper scaling weight is decided upon, small changes are not necessary. The important point is that because of the accuracy and uniformity of Do-Maker dough weights, there is no need for excessive overscaling. Do-Maker dough, as produced and divided, is of uniform density, which is not the case in batch operation where the last part of a hopperful of dough can become more "gassy" than the first part.

Loaf size can be shifted quickly from a 1-pound to a 1½-pound loaf by changing the speed and the adjustment of the panner, which is synchronized with the divider. The rate of dough production may or may not be changed at this time; for example, 90 pounds of dough per minute may be divided into 77 dough pieces of 18¾ ounces each, or 64 pieces of 22½ ounces each.

Formulation

A more or less typical formula is used for Do-Maker bread, similar to one used in conventional operation: per 100 pounds of flour, yeast 2–3%; shortening 3%; milk 2–6%; salt 1.5–2.25%; and yeast food (Arkady or Fermaloid type) 0.25–0.5%. Because of the comparatively short contact time between broth and flour, enzymic additives are less useful; this includes added lipoxidase which apparently does not function effectively. Vitamins in tablet form are added to the broth. (A properly enriched flour would also be a suitable way to add enrichment.) For mold control, especially indicated in the summer months, sodium or calcium propionates or diacetate can be added via the broth route very satisfactorily. Other adjuncts go into variety breads such as wheat bread, buttermilk bread, etc., but the major production is in white bread. Yeast food is added primarily for yeast stimulation and nutrition, but the water-conditioning salts are useful in regulating fermentation and dough properties.

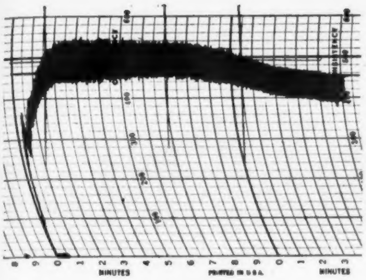
Sometimes acid calcium phosphate or calcium sulfate can be added to advantage in addition to the mineral salts in the yeast food. The oxidizing constituents in the yeast food are spent in the broth before reaching the flour, so really are not functioning as flour improvers in this process. In case a no-milk (or lean formula is used, buffers are added to the broth. In England, of course, calcium carbonate is added to the flour and can be added to the broth if necessary.

While this listing of ingredients shows some flexibility in choice of formula, the quality of the ingredients is also important for good bread, just as it is in any process.

Ingredients: Flour

Bread-type flour, well milled from sound wheat, is basic. Good results have been obtained from flours made from hard red spring wheats, hard red winter wheats, and blends thereof. The flour should have good mixing and machining tolerance. Flours have been used having ash ranges from 0.39 to 0.45%, and protein ranges from 11.4 to 13.0%. Depending somewhat on the baker's location, costs, etc., the flours chosen probably will have so-called "strong" properties and a protein content of 12% or better, and will produce a farinograph curve similar to that shown on the next page.

In a few instances some trouble has been experienced with overground (dead-milled) flours. These flours show higher absorption and usually good mixing curves, but since the



Farinograph curve.

broken starch cannot be fermented out in Do-Maker operation as in the conventional sponge processes, a poor dough results. Such doughs are putty like and lose gas during pan-proof.

Ingredients: Milk

Good baking milks of normal odor and flavor are necessary, since an off-odor can be carried through the broth and into the bread. Just as in the conventional methods, both spray-dried and roller-dried milk of good quality have been used, with good results.

Ingredients: Shortening

Since most Do-Maker doughs are made rather warm (98°–104°F.), a summerized-type of shortening has given best results. Lard, a compound lard, and a hydrogenated vegetable-type shortening properly adjusted have yielded excellent results. Besides the effect of shortening on dough properties and on bread crumb, some effects contribute to flavor. Shortening is applied in the melted state (preferably not over 140°F.) to the dough-up of flour and broth in the premixer. Delivery of shortening must be uniform, or poor doughs, showing gas leakage at proof and in the forepart of the oven, will cause blistered and tunneled loaves of small volume. When extra softness is desired, bread softeners such as mono- and diglycerides are first melted and then added to the melted shortening to assure good mixture.

Some Operational Precautions

There are recommendations and suggestions for the Do-Maker just as there are in the instruction book of a new automobile. The shortening not only must be applied with some care, as indicated in the paragraph above, but the *melted* shortening must always be there and *on time.* Pump failure, or a plugged-up shortening line, are matters of some concern. Between-run maintenance and clean-up are important on this single element just as they are on the whole machine. The broth lines, including regulating devices and heat exchanger, must be thoroughly flushed out between runs and sanitized periodically. These precautions in cleanliness and sanitation apply to broth tanks, premixer dough pump, and developer. Actually a proper installation provides all facilities for easy and scrupulous clean-up. The duties of the clean-up staff are no more exacting and probably no more time-consuming than in any other well-managed food plant. All pumps and feeders need good maintenance and occasional checking for capacity and delivery.

Start-up dough, which may be as much as 90 pounds, is fed back into the premixer slowly so that the mixing requirement of the main stream is not upset. Any shut-down dough in the developer is refrigerated and fed back the following day, or worked up into other goods. Flour dust must not be allowed to accumulate in the electrical control equipment, and since no dusting flour is used in the Do-Maker process, insect hazard is negligible. Because pans must always be well greased, the greaser must always be operating properly. Silicone surfacing is satisfactory but may require light greasing. Since Do-Maker dough is warm and somewhat soft and sticky (usually being developed to hold a maximum of gas), this requires proper greasing of pans as well as good adjustment of the proofer with proper humidity, and reasonable care in handling the racks. Do-Maker dough is lively and must be treated accordingly. In some instances oven heat must be adjusted for best results, but in general, uniform, even heating, with every dough piece alike, is the goal. If oven trays are solidly built they deflect heat, but mesh-type construction lets it through and permits more uniform heat flow. It is expected that because of Do-Maker oven and proof box construction and control will improve, as with any new process.

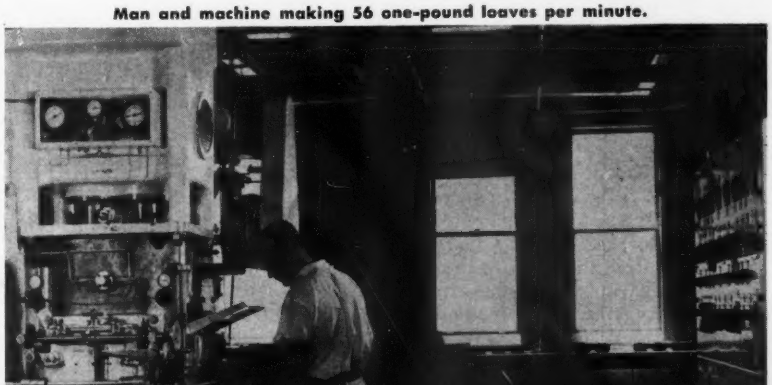
No special precautions are needed in making up the oxidizing solution, except to be sure that the water is clean and the crystals of bromate and iodate are all dissolved. Amounts are adjusted for flour requirement, and calculations are based upon uniform delivery of the solution. The oxidizing reagent contained in the amount of solution delivered must treat at the proper rate the amount of flour flowing per minute.

Summary

Pertinent literature on the Do-Maker process follows. The present discussion has attempted to bring up to date the economic and technological points of these various papers and to emphasize the importance of the entire program of automatic operation within industry. Its outstanding advantages are uniformity of production and product and the economical use of floor space, labor, and power.

(Please turn to page 190)

Man and machine making 56 one-pound loaves per minute.

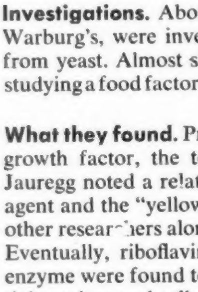


The Vital Stor

A Quick History. Independent investigators, working separately to unlock several of nature's doors, sometimes open up unsuspected relationships. This happened with vitamin B_2.

Investigations. About 25 years ago, several groups, notably Warburg's, were investigating a "yellow enzyme" obtained from yeast. Almost simultaneously other investigators were studying a food factor that aided growth of laboratory animals.

What they found. Proceeding with chemical analysis of this growth factor, the team of Kuhn, György, and Wagner-Jauregg noted a relationship between the growth-producing agent and the "yellow enzyme." Their findings, and those of other researchers along similar lines, were published in 1933. Eventually, riboflavin and an essential part of the yellow enzyme were found to be identical and the unity of an essential nutrient and cellular metabolism was established.

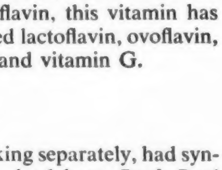


Isolation of pure riboflavin was achieved by Kuhn and his co-workers, and by Ellinger and Koschara, in 1933.

Nomenclature. Known in the United States as riboflavin, this vitamin has also been called lactoflavin, ovoflavin, hepatoflavin, and vitamin G.

SYNTHESIS

By 1935, two eminent chemists, working separately, had synthesized riboflavin, practically in a dead heat. Prof. Paul Karrer of the University of Zurich, a collaborator of the Hoffmann-La Roche Laboratories, produced the first successful synthesis. Five weeks later Richard Kuhn of Germany announced his synthesis of the vitamin. Prof. Karrer subsequently shared the Nobel Prize in Chemistry for his work in vitamins and carotenoids.



The Karrer synthesis forms the basis for chemical processes in widespread use today by Hoffmann-La Roche and other leading manufacturers throughout the world. Riboflavin is also manufactured today by fermentation methods.

CHEMICAL AND PHYSICAL PROPERTIES

Riboflavin is yellow, slightly water-soluble with a greenish fluorescence and a bitter taste. Its empirical formula is $C_{17}H_{20}N_4O_6$. Vitamin B_2 produced by the Roche process is identical in every way with that occurring in nature.

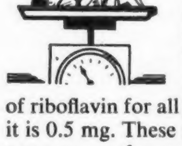
How does vitamin B_2 work? Riboflavin is a vital part of nature's chain of reactions for utilization of carbohydrate energy. It has been found to be a constituent of many enz systems and is thus intimately connected with life proce It is probably required by the metabolic processes of every animal and bird as well as by many fishes, insects and lower forms of life. (In certain animals, however, the requirement may be synthesized by bacteria within the intestine.)

In the cells riboflavin goes to work attached to a phosphate group. This substance, known as riboflavin-5′-phosphate or flavin mononucleotide, may in turn be attache still another essential substance, adenylic acid, forming fla adenine dinucleotide. Either nucleotide then is attached protein, thereby forming an enzyme, and takes its part oxidation-reduction reactions.

Requirements in Human Nutrition. As we have seen, vi min B_2 is essential to life. We have no special storage org in our bodies for this vitamin, although a certain leve maintained in various tissues, with relatively large amou found in the liver and kidneys.

MEASURING METHODS

In the beginning, riboflavin activity was described in "Bo quin-Sherman units" and requirements were thought to very small. Subsequent research show otherwise. Milligrams of weight beca the unit and the Food & Drug Admin tration of the U. S. Dept. of Heal Education & Welfare has established minimum daily requirement of 2.0 m of riboflavin for all persons 12 or more years old. For infa it is 0.5 mg. These requirements are designed to prevent t occurrence of symptoms of riboflavin deficiency disease. T minimum daily requirement for this vitamin for childr from 1 to 12 years has not been established by the F. & D.



Recommended allowances. The Food & Nutrition Boa of the National Research Council has recommended the fo lowing daily dietary allowances of riboflavin, expressed milligrams. These are designed to maintain good nutrition healthy persons in the U. S. A.

Men	1.6	
Women	1.4	
" (3rd trimester of pregnancy)	2.0	
" (Lactating)	2.5	
Infants, 1-3 months	0.4	
" 4-9 "	0.7	
" 10-12 "	0.9	
Children, 1-3 years	1.0	
" 4-6 "	1.2	
" 7-9 "	1.5	
	Boys	*Girls*
Adolescents, 10-12 years	1.8	1.8
" 13-15 "	2.1	2.0
" 16-20 "	2.5	1.9

r of VITAMIN B$_2$ *by* Science Writer

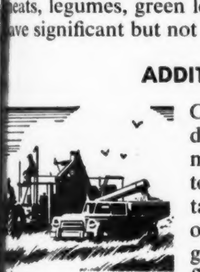
(Riboflavin)

ficiencies of vitamin B$_2$ appear in several ways in human ings. The eyes, the skin, the nerves, and the blood show the ects of too little riboflavin. Laboratory imals have demonstrated that a ribo-vin-deficient diet can cause death of ults and can slow or stop growth in the ung. Female animals, deprived of ribo-vin in the diet, may produce offspring ith congenital malformations.

edical uses. To overcome and control deficiencies in man beings, physicians have pure riboflavin available for ministration by injection or orally, by itself or with other B" vitamins or multi-vitamin-mineral combinations.

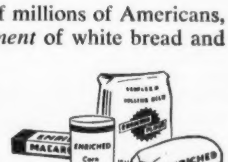
ow do we get our daily riboflavin? Vitamin B$_2$ has ide distribution throughout the entire animal and vegetable ngdoms. Good sources are milk and its products, eggs, eats, legumes, green leaves and buds. Whole-grain cereals ve significant but not large amounts of riboflavin.

ADDITION TO FOODS



Cereal foods play a large part in our diet. To produce the white flour almost all of us want, millers are obliged to remove parts of the wheat that contain much of the grain's riboflavin and other nutrients. In addition, cereal grains are not rich sources of riboflavin. Millers meet this problem by nriching the grain foods for which federal standards exist ith vitamins B$_1$, B$_2$, niacin and the mineral iron. In the case f vitamin B$_2$, however, they do more than *restore* the processed food to its natural riboflavin level; they *fortify* the food ith enough of this essential vitamin to make it nutritionally ore valuable than it was in nature.

cting to protect the good health of millions of Americans, akers and millers adopted *enrichment* of white bread and hite flour in 1941. Since that time, ther foods, such as macaroni products, corn meal and grits, farina, astina and breakfast cereals have ad their food value increased by nrichment with pure riboflavin nd other vitamins and minerals.

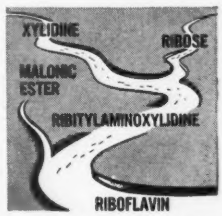


When enriching, fortifying or restoring, food manufacturers add the necessary quantity of riboflavin (and other vitamins and minerals) to the food during processing, so that the finished product meets federal, state, and territorial requirements or contributes to the consumer an amount of the vitamin that dietary experts believe significantly useful.

PRODUCTION

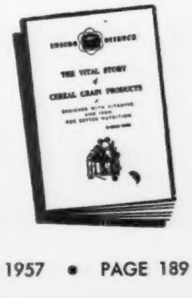
Prof. Karrer's synthesis of riboflavin was a laboratory success. Adapting the process to commercial production, however, demanded original thinking by chemists at Hoffmann-La Roche. The production of riboflavin by chemical synthesis requires the production of ribose, a rare sugar, at an early stage in the process. This special sugar must be made inexpensively if the synthesis is to be practical. Sugar chemistry is a difficult matter. In a brilliant piece of work, the Roche chemical experts developed a method to produce ribose on a commercial scale by an electrolytic process, thus overcoming a most troublesome problem. Subsequently, Roche chemists developed the first practical synthesis for riboflavin-5′-phosphate, identical with natural flavin mononucleotide.

Picture three streams joining to form a river and you have a simplified idea of the Roche process for synthesizing vitamin B$_2$. O-xylene and glucose are processed separately to form xylidine and ribose respectively. These are joined to form ribitylxylidine, which is then converted to ribitylaminoxylidine. Starting separately with malonic ester, which is processed through intermediate stages to alloxan, the third "stream" is then joined with ribitylaminoxylidine to form riboflavin. Purification occurs at each step of the synthesis. Riboflavin 'Roche' equals or exceeds U. S. P. standards.



By the tons. So efficient is the Roche process that pure riboflavin is produced *by the tons* for use in pharmaceutical products and processed foods. An interesting development by Roche is the production of riboflavin in different forms related to the method of end use. 'Roche' Regular riboflavin U. S. P. is especially useful in dry enrichment premixes, powdered dietary supplements, pharmaceutical tablets and soft gelatin capsules. 'Roche' Solutions type is preferred for the manufacture of solutions having low concentration. 'Roche' Riboflavin-5′-Phosphate Sodium is a highly and rapidly soluble riboflavin compound favored for all pharmaceutical liquid products and some tablets, lozenges, and capsules. It has a more pleasant taste than the bitter U. S. P. riboflavin.

This article is published in the interests of pharmaceutical manufacturers, and of food processors who make their good foods better using pure riboflavin 'Roche.' Reprints of this and others in the series will be supplied on request without charge. Also available without cost is a brochure describing the enrichment or fortification of cereal grain products with essential vitamins and minerals. These articles and the brochure have been found most helpful as sources of accurate information in brief form. Teachers especially find them useful in education. Regardless of your occupation, feel free to write for them. Vitamin Division, Hoffmann-La Roche Inc., Nutley 10, New Jersey. In Canada: Hoffmann-La Roche Ltd., 286 St. Paul St., West; Montreal, Que.



Do-Maker:

(Continued from page 187)

Operations in both milling and baking have tended more and more toward automation during recent years, the former perhaps a little more so. The baking industry, in the present conventional system, is handicapped by the work that needs to be done ahead of the proofer. The continuous processes can be cut off rather sharply and set back in operation with less trouble than batch processes. The feeding elements, just as the bleaching and maturing machinery and the feeders used in flour milling for applying enrichment, must be built for continuous operation. They must be reliable. They can't quit!

So much for the equipment; now a word about the men who run the machines. The change-over from the conventional to the continuous is no terrifying event. True, the operator must keep alert, on his toes. A lively dough such as the Do-Maker's may be an incentive to keep interested.

The future of continuous mixing is indeed bright, and it can be predicted that many bakeries, if not the majority of them, will be equipped for it as rapidly as possible.

Publications and Releases

1953—Continuous dough mixing — its advantages and limitations, P. G. Pirrie, *Bakers Weekly* (Feb. 9).

1953—W. & T. Process Co. announces the development of the J. C. Baker Do-Maker Process. W. & T. news release (May 11).

1953—Some remarks concerning the J. C. Baker Process for the continuous manufacture of bread doughs. W. & T. news release (May 12).

1953—A pioneer of progress in the food industry at W. & T. Process Co. *Food Processing* (July).

1954—Continuous processing of bread. J. C. Baker, address before A.S.B.E. (March 1).

1954—Frozen bread and continuous process discussions featured in A.S.B.E. meeting. *Baking Ind.* (March 13).

1954—Continuous breadmaking is described to engineers. *Food Field Reporter* (March 22).

1954—Makes bread faster. *Food Eng.* (April).

1954—Engineers hear inventor describe his continuous bread mixing process. *Amer. Baker* (March).

1955—Automation in the baking industry. C. E. Misch, *Bakers Digest* (Oct).

1955—Superior quality bread produced by J. C. Baker Do-Maker Process leads to tremendous increase in sales. *Food Processing* (Oct.).

1956—Flour to fermented dough in 2 minutes. *Food Eng.* (Oct.).

1956—How engineering revolutionizes old art of breadmaking. *Food Eng.* (Oct.)

1957—Status report on continuous mixing. M. T. Tiernan, address before A.S.B.E. (March).

1957—Performance report on continuous baking. Ray S. Briggs, *Proc. A.S. B.E.* (In press).

CHEMICAL AND BAKING CHANGES WHICH OCCUR IN BULK FLOUR DURING SHORT-TERM STORAGE[1]

D. B. PRATT, JR., Technical Director, Soft Wheat Section, Headquarters Quality Control Laboratory, Pillsbury Mills, Inc., Minneapolis, Minnesota

INTRODUCTION OF BULK flour handling systems into the baking industry has resulted in a great many questions to cereal chemists regarding what changes take place in the flour during the storage period immediately subsequent to manufacture. The fact that most bakers have established minimum aging requirements for their flour has long been known, yet the reasons for this have not been thoroughly investigated.

The changes which occur during storage of flour and wheat over prolonged periods of time have been observed and reported by Fisher, Halton, and Carter (2), Jones and Gersdorff (3), and Milner and Geddes. However, none of these studies have included information covering the changes during the first few weeks after the flour is milled.

Since commercial bakers usually bake with flour within 30 days after milling, this study was undertaken with particular emphasis on flour loaded in bulk and stored for this period of time.

An Airslide railway car was loaded at Atchison, Kansas, on October 17, 1956, with a bleached standard patent bakery flour containing 0.43% ash and 12.10% protein. The flour was milled from 100% new crop Kansas wheat of normal baking strength. After loading, the car was moved to a freight siding and held for 3 weeks, during which time the studies were made.

Thermocouples attached to a strip chart recorder were placed inside the car in both the air space above the flour and buried in the flour so as to obtain a record of temperature changes within the load in the following places corresponding to the numbered circles in Fig. 1: (1) 6 in. below the surface and 6 in. from the outer wall; (2) 12 in. below the surface and 12 in. from the outer wall; (3) 2 ft. below the surface and 2 ft. from the outer wall; (4) 3 ft. below the surface and 3 ft. from the outer wall; and (5) 3½ ft. below the surface and 3½ ft. from the outer wall (this represents the approximate center of the load).

A Minneapolis-Honeywell gold-leaf humidity-sensing element was suspended in the air space above the flour. This was connected to a power-driven strip chart recorder.

Provision was made to withdraw a small sample of the air above the flour for analysis on a daily basis for air and oxygen content.

Samples of the flour were removed through the unloading hatch at the bottom of the car on an every-other-day basis (i.e., day 1, 3, 5, 7, 9, etc.). These samples were

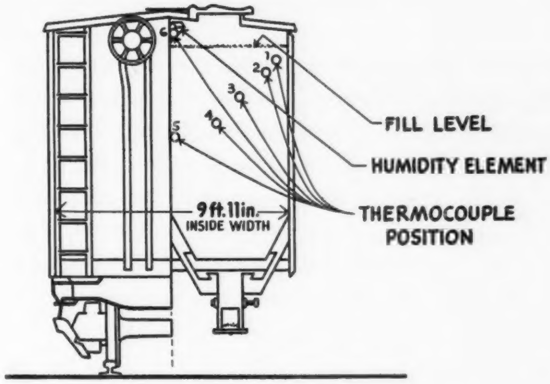


Fig. 1. Cross section of bulk car showing temperature and humidity elements.

analyzed for moisture, ash, protein, maltose (Blish-Sandstedt), amylograph, gassing power, microbiological population, and total reducing substances. They were subjected to extensograph and farinograph testing and finally baked in the pilot bakery of the C. J. Patterson Laboratories, with a commercial sponge formula and procedure. The doughs were based on 200 lb. of flour. Finished bread was scored by three experienced scorers 24 hours after baking. Average loaf scores for nine loaves of bread are recorded for each baking test, representing the first, middle, and end of the doughs.

Prior to the initial run of the test flour, an identical fresh flour was baked to determine optimum absorption, mixing, and fermentation requirements, as well as yeast food and enzyme supplements. Once these factors were established, the baking procedure was held constant for the entire series of tests; thus any change in bread quality could only be the result of changes in the flour.

Atmospheric and temperature changes within the bulk car are presented in a series of graphs and charts.

Figure 2 shows the flour temperatures within the loaded car. The flour temperature changes in a daily cycle. Daytime temperatures of the air-head show a rapid rise and while the flour follows outside air only slightly, it is af-

[1] Manuscript received June 3, 1957.

fected by changes in ambient temperature. The high temperatures achieved in the air-head are due to absorbed heat from the sunlight and the rate of increase is quite rapid. The cooling cycle is almost as abrupt during the night time. The flour load does not reach the ambient low, but declines gradually during storage. On the days when there was no sunlight, temperatures remained relatively constant throughout the full 24 hours, with a slight spread between the outer positions and those nearer the center of the car.

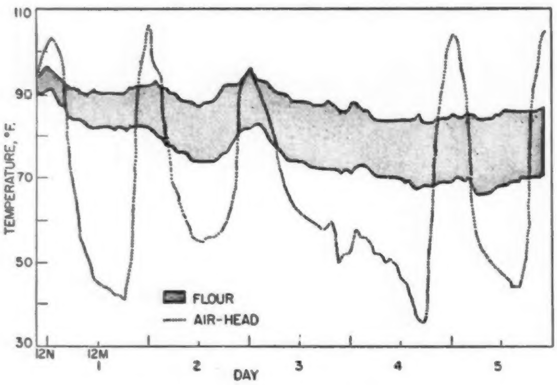


Fig. 2. Temperature changes within car.

Relative humidity within the car, as shown in Fig. 3 by the solid line, fluctuates with temperature of the flour (dotted line) and air-head above the flour (broken line). This graph shows only the mean flour temperature.

Using water vapor tables the grains of water per cubic foot contained in the air space over the flour have been calculated. These values are shown in Table I. There is a gradual decline in the water content of the atmosphere. This is reflected in a change in the moisture content of the flour, which will be presented later.

TABLE I
WATER CONTENT OF AIR ABOVE FLOUR[a]

Day	Relative Humidity High	Relative Humidity Low	Relative Humidity Mean
			grains/cu. ft.
1	16.36	11.00	13.68
2	18.34	10.39	14.26
3	17.32	9.19	13.25
4	11.96	9.19	10.57
5	7.03	10.39	8.71
6	12.12	10.26	11.19
7	11.90	9.82	10.86
8	12.75	11.19	11.97
9	7.40	7.04	7.22
10	9.16	10.19	9.68
11	7.99	10.89	9.44
12	11.96	10.87	11.41
13	9.16	10.68	9.92
14	10.40	7.12	8.76
15	9.76	10.19	9.97
16	8.06	9.69	8.87
17	8.90	8.79	8.84
18	12.33	8.59	10.46
19	10.69	8.99	9.84
20	11.56	....	....

[a] Calculated from Relative Humidity and dry bulb values.

Changes in the oxygen content of the air above the flour as determined by analysis with a Burrell-Haldane micro-gas analyzer are shown in Fig. 4. Values depicted for both oxygen and carbon dioxide are corrected for water vapor and to constant barometric pressure. There is a gradual decline in the oxygen content during the first few days after milling with a maximum change evident during the seventh through the eleventh day.

Carbon dioxide content of the air increases as shown in Fig. 5 in much the same pattern, with the maximum change occurring at the same time as does the oxygen.

The changes in air composition are probably of respiratory origin, and at least in part must be associated with the changes occurring in the bacterial and mold popula-

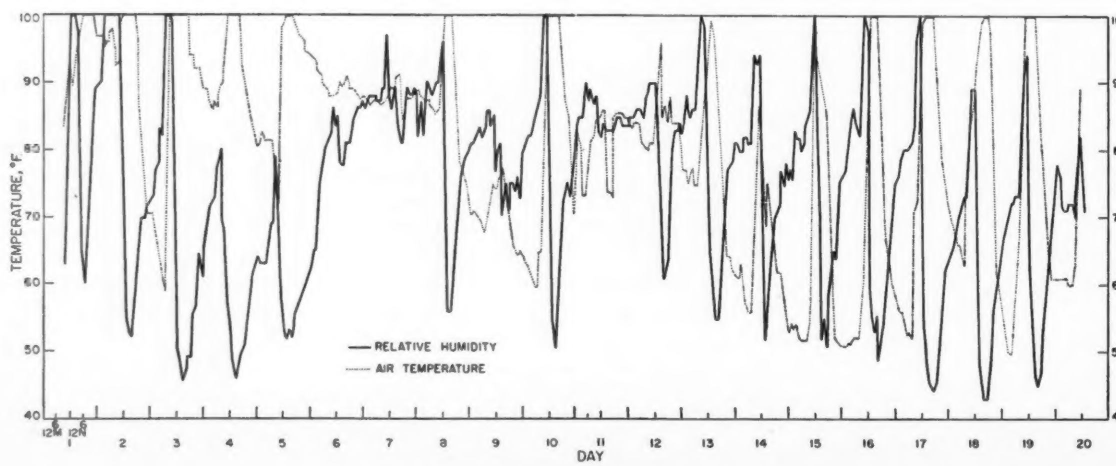


Fig. 3. Relative humidity within car.

tion of the flour as listed in Table II. The maximum population is evident at the same time that the greatest change has occurred in air composition.

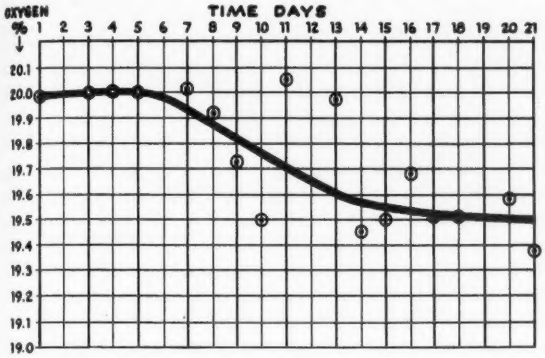


Fig. 4. Oxygen content of air-head in percent vs. storage time.

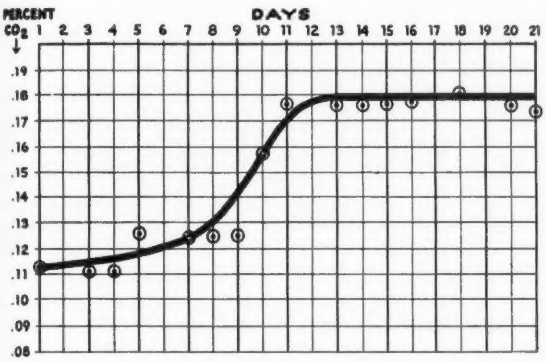


Fig. 5. Carbon dioxide content of air-head in percent vs. storage time.

TABLE II
Microbiolicical Studies

Age	Bacteria per Gram	Mold Count per Gram
days		
2	3800	<100
6	4200	<100
8	5500	<100
10	5200	800
12	2100	1000
14	2500	1100
16	1100	<100
18	900	<100
20	1800	<100
20 (Top surface)	9200	<100
8th Day [a]	2900	3900
20th Day [a]	1400	<100
16th Day [b]	4300	900

[a] Bag.
[b] Chilled.

Chemical and Physical Tests

In Table III the conventional chemical factors of the flour are listed. The only significant change evident in these values is the slight increase in moisture content which would explain the decrease in water content of the air above the flour, and lead to the logical assumption that the flour has absorbed this moisture.

Gassing power as determined by the pressuremeter method (1) is shown in Table IV. These values remain constant within the range of experimental error.

TABLE III
Chemical Factors of the Flour

Day	Moisture	Protein [a]	Ash [a]
1	13.7	11.98	0.430
3	13.57	12.10	.430
5	13.70	11.94	.430
7	13.65	12.10	.428
9	13.70	12.10	.430
11	13.77	12.14	.430
13	13.77	12.22	.430
15	13.80	12.10	.432
17	13.77	12.06	.428
19	13.90	12.02	0.430

[a] Converted to 14% moisture basis.

TABLE IV
Gassing Power, Corrected to Constant Atmospheric Pressure

Day	Gassing Power
	mm. Hg
1	476
3	488
5	482
7	466
9	459
11	473
13	470
15	472
17	474
19	475

Maltose values determined by the Blish-Sandstedt method (1) are shown graphically in Fig. 6. There is a gradual decline in this value indicating some deterioration as regards this factor.

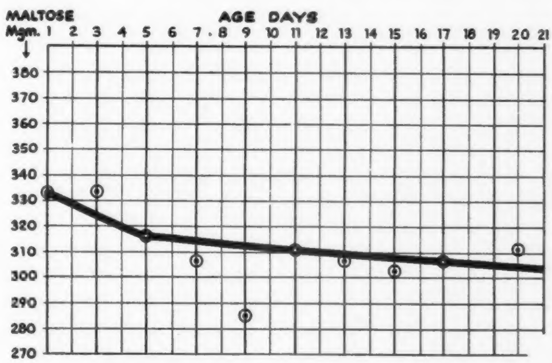


Fig. 6. Maltose value vs. flour age as milligrams maltose sugar.

Amylase activity as measured by standard amylograph procedures corroborates the maltose values. There is a gradual increase in hot paste viscosity (see Fig. 7).

Total reducing substances as determined according to the method described in *Cereal Laboratory Methods* (1) are shown in Fig. 8. There is a gradual decline in reducing substances. This is probably due to natural oxidation which has occurred during the storage period.

Farinograph values are shown in Table V. These show a slight decline in "A" dimension as the flour ages, indicating a more rapid uptake of water by the flour. "Peak time" as represented by "B" dimension remains un-

changed. The "C" dimensions represent the total time during which the curve remains above the 500 consistency line. This interval increases slightly. The "D" dimension is Mixing Tolerance Index. This factor increases slightly as the flour ages. Valorimeter measurements remain constant.

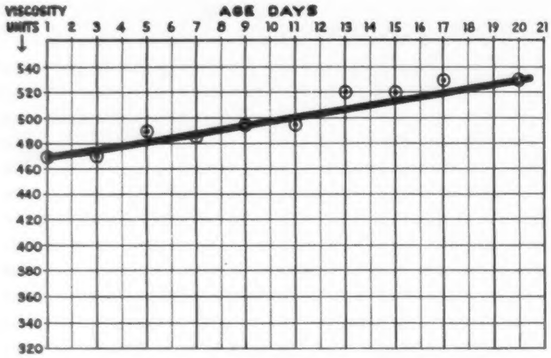


Fig. 7. Amylase activity vs. flour age; amylograph values in Brabender Units.

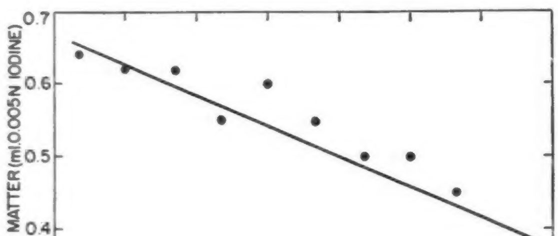


Fig. 8. Total reducing substances as milliliters 0.005N iodine.

TABLE V
RECORDING DOUGH MIXER VALUES

Day	Absorption	Dimension A	Dimension B	Dimension C	Dimension D	Area
1	61.2	3.0	7.75	9.0	50	67
3	61.2	3.5	7.75	8.0	50	66
5	61.0	3.0	7.5	8.5	50	66
7	61.5	3.0	7.75	9.0	50	67
9	61.2	3.5	8.0	8.5	55	67
11	61.2	3.5	7.75	8.5	55	67
13	61.2	2.0	8.0	10.0	60	67
15	61.9	2.0	7.75	10.0	60	66
17	61.5	2.25	8.0	10.5	60	67
19	61.6	1.75	7.5	10.0	60	67

Extensograph® values for extensibility as plotted in Fig. 9 show a rather slight increase in extensibility up to the 13th day of storage. After 60 minutes' rest, however, the 180-minute rest values show a slight reversal of this trend, with the doughs showing a decrease in extensibility up to the 13th day, then a gradual increase thereafter.

Resistance to extension is shown in Fig. 10. Both 60-

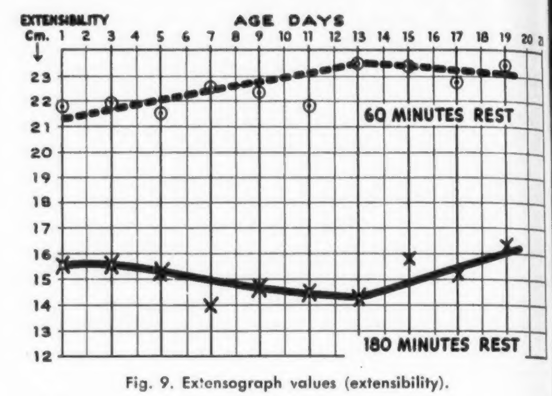


Fig. 9. Extensograph values (extensibility).

and 180-minute resistance figures show an increase in resistance to extension up to the 8th day of storage with a gradual decrease thereafter. The significance of this change as it affects baking performance will be shown later.

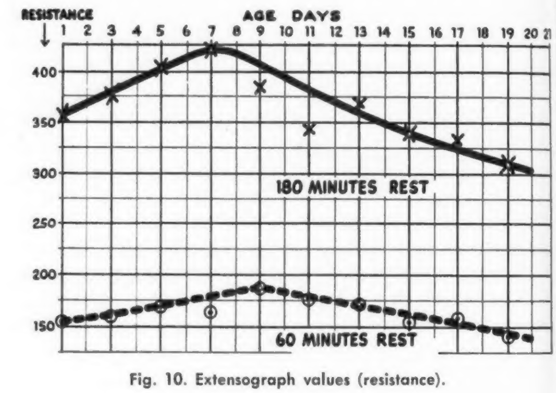


Fig. 10. Extensograph values (resistance).

Baking Tests

Bread quality scores are shown in Table VI. There is no significant change in bread quality. Those values designated in the table as "B" are bagged flour of the same

TABLE VI
BREAD QUALITY SCORE AND VOLUME

Day	Score Front	Score Middle	Score End	Score Average	Volume (Average)
					cc.
2	89	90	89	89.6	3150
4	88	89	88	88.6	3208
6	87	88	89	88.0	3233
8	88	88	88	88.0	3149
8B[a]	88	87	88	87.6	3192
10	88	88	88	88.0	3254
12	89	88	88	88.6	3143
14	88	87	87	87.3	3252
14B	88	88	87	87.6	3254
16	88	87	88	87.6	3291
16C[b]	88	87	88	87.6	3321
18	89	88	88	88.3	3286
20	89	88	90	89.0	3205
20B	88	88	88	88.0	3204

[a] B represents bagged flour.
[b] C represents chilled flour.

age as the bulk flour. A single test is also designated as 16 C. This covers flour that was removed from the car

on day 8 and placed in 0°F. storage until day 16 when it was removed and baked with no special treatment other than water temperature adjustments to achieve proper sponge and dough temperatures. There was no significant change in quality of bread baked from this flour.

It must be noted, however, as concerns the chilled flour, that the sponge and dough from this sample had all the characteristics of overmixing. This dough was mixed according to the established optimums, disregarding the actual appearance of overmixing, and the bread was comparable to that obtained from flour of normal temperatures.

TABLE VII
Dough Development Data from Electrical Power Input

Flour Age	Chart Height				Time to Peak	Area
	8 Minutes	10 Minutes	12 Minutes	Peak		
days						
2	15	25	36	44.5	15.0	50
4	30	41	51	51.0	13.0	64
6	14	24	39	48.0	15.0	39
8	15	26	39	48.0	16.0	52
10	16	29	40	47.0	16.0	55
12	13	24	36	46.0	15.25	50
14	13	24	36	45.0	16.75	48
16	17	31	40	44.0	15.0	54
18	14	25	38	44.0	15.75	48
20	13	23	36	46.5	16.0	51
8B[a]	22	40	45	49.0	14.75	61
14B	16	32	40	46.0	16.0	55
20B	14	30	37	48.0	15.0	53

[a] B represents bagged flour.

Mixatron values of the developing bread doughs are shown in Table VII. These values do not appear to be of particular significance in showing changes in the flour beyond a slight increase in curve height up to day 8 of storage. This coincides with the values obtained with the extensograph where greatest resistance to extension occurred at the same time. This same phenomenon is evident in proof time values.

Figure 11 is the proof time charted against flour age. Notable is the fact that proof time increases concurrently with resistance to extension, and declines in the same manner as did the extensograph values shown in Fig. 10.

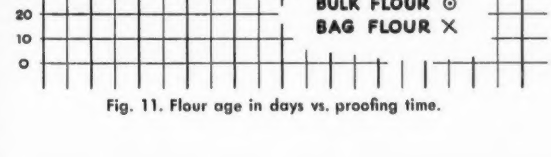


Fig. 11. Flour age in days vs. proofing time.

Conclusions

The data presented herein indicate that there are some minor chemical and physical changes in flour during short-time storage. These changes occur at their greatest rate during the period from the 7th to 11th day. Commercial-size baking tests indicate that these changes are not of sufficient amplitude to be detected in the baking test. This, however, assumes that the flour is handled in the same manner throughout the entire storage period. It is safe to assume that, should a baker attempt to adjust his plant to a flour during the 7-to-11-day period, he might be misled into improper mixing or handling which would result in inferior bread quality. These tests would indicate that a bakery should establish baking procedures with matured flour or fresh flour, then hold handling methods constant.

The phenomenon referred to as "sweating" or greenness was in slight evidence in sponges and doughs during the period of maximum change where doughs appeared wet and clammy. Change in baking procedure to adjust to these characteristics might have resulted in bread of inferior quality.

That some sort of respiration did occur in the bulk flour during short-time storage is obvious in the data obtained through analysis of the air above the flour. It would appear likely that this respiration is microbiological in origin. The decline in total reducing substances contained in the flour might be responsible for some of the change in oxygen content. However, this will not account for the rise in carbon-dioxide content of the air-head.

The changes in maltose values, either by amylograph or Blish-Sandstedt method, are of interest and some investigation into the cause of this might prove interesting. Flour is a complex substance and many other tests might have been undertaken as a part of this study. However, the data reported may prove of value in stimulating others to look more closely at the short-term changes in flour, since they are of vital importance to bakers in their efforts to produce high-quality bread, and at the same time avail themselves of the economic gains to be achieved through the use of bulk flour storage.

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the President's Corner

news of the association

AACC TECHNICAL COMMITTEE WORK

Technical committee work has been a part of the American Association of Cereal Chemists since its beginning in 1915.

In 1922 when the AACC amalgamated with the milling and baking technologists, the aim of the new Association, as stated in the Constitution, was "To reach by means of research and discussion, agreement in methods of analysis necessary in the cereal laboratory. The object to be accomplished is the establishment of standard methods of procedure in the analysis of cereal products." When the Association became incorporated under the laws of the State of Minnesota in 1956 it maintained the original objective to study, develop, and adopt uniform or standard methods of examination and analysis of cereal products. From the beginning, then, the objectives have been definite and deviation has been slight during the intervening years.

The Technical Policy Committee

There are several ways in which an association such as the AACC can achieve its aims. Its Constitution, unlike that of several sister organizations, failed to outline how this should be done, and it has been left to each succeeding group of officers to decide how they might best achieve the goals. Technical committee assignments customarily have been made by the president. This has provided for flexibility to meet ever-changing demands and conditions, but has contributed to lack of continuity in certain committee work. By 1954 the work of the office of the president became so great that the Executive Committee created the Technical Policy Committee, to assume the responsibility of organizing and executing the work of the technical committees and achieving the goals as set forth in our Constitution. While there is thus a form of an organization to carry out the objectives of our Association, success is not achieved necessarily by mere organization; it is more dependent upon individuals and their willingness to assume responsibilities. The Association has been successful, to a degree, because many individuals have been willing to give their labors to the solution of their common problems.

Technical Committees

The Association began with a few technical committees, to investigate such analytical methods as those used for determination of moisture, ash, and protein. Today, there are 18 technical committees with approximately 150 members represented. This means that slightly over 15% of our members are active, to some degree, with technical committee work. This is not a large percentage and there should be more members engaged in this type of activity. There is also a need for more definite goals within many of the committees and, on the part of certain other committees, a need for more fervent effort to achieve them. The Technical Policy Committee, composed of the chairmen of each of the technical committees, serves to set policy regarding how the objectives of our Association, as related to adoption of methods of analysis, shall be carried out.

Cereal Laboratory Methods Work

More than a quarter of a century ago, the Association undertook the task of bringing together in a convenient form all methods that were commonly used in cereal laboratories. The sixth edition came off the press in 1957. It is an enlarged edition containing many of the old but revised methods and, in addition, many new ones, and is the result of constant effort on the part of the technical committees to improve and develop methods of analysis of cereal products. During the final stages of the printing of this edition the Technical Policy Committee performed the gigantic task of technical review of the galley proofs. This took hours of work and the task would have been impossible without help from the technical committees.

Looking Ahead

The Technical Policy Committee has been concerned during the past year with the problem of how technical committee work can be made more effective. The committees are expected to publish their conclusions and recommendations in one of the AACC publications, in order to bring to the membership the benefits from work designed to standardize methods of analysis.

The Technical Policy Committee is developing a plan which might make committee work more effective. The technical committees would offer to review all methods applicable to the cereal laboratory and classify them either as *official* or *tentative*, or by some similar terminology. The recommendation of each committee would be reviewed by the Technical Policy Committee.

With respect to the development of new methods, new technical committees should be created as the demand dictates, or the problem may be assigned to a committee already in existence. New methods should be classified as *tentative* for at least three years, during which time the membership should have the opportunity to use and examine the methods.

Finally, to make a tentative method official, the specific technical committee would make a recommendation to the Technical Policy Committee who would review it, publish it in CEREAL SCIENCE TODAY, and move its adoption as *official* at one of the annual meetings. Majority vote should be required in order to make any method official. Thus, AACC members would have the final disposal.

The Technical Policy Committee recommends that *Cereal Laboratory Methods* be revised and printed again in 1962. They are considering the possibilities of publishing the book as a loose-leaf laboratory manual. New and revised methods would be published each ensuing year, and the book would be reviewed and where necessary revised, both editorially and technically, each year. Thus every cereal analyst would have an up-to-date laboratory manual which constantly provides the newest information as developed by the technical committees.

JOHN A. JOHNSON
Chairman Technical Policy Committee

OVERSEAS REPORTS

. . . Japan

Some concise information on consumption of cereals in Japan may present a clearer view of a picture that is familiar to most cereal and food scientists only in general outline. Japan's 90 million people annually consume 16 to 17 million tons of cereals, while producing only 12 to 13 million tons; about 70% rice, 20% barley, and 10% wheat. Hence, some 3½ million tons must be imported —roughly 50% wheat, 15% barley, and 25% rice. The following table indicates imports of cereals in recent years:

Year	Imports: Rice (tons)	Imports: Wheat (tons)	Imports: Barley (tons)
1952	90,800	159,500	118,100
1953	145,300	189,400	77,200
1954	88,100	211,000	53,500
1955	128,900	224,100	72,400

Rice. Cooked almost invariably in water only, rice occupies the main part of the Japanese diet. Not only is it the most popular cereal among the Japanese people, but their own home-grown round, glutenous japonica type is preferred to the nonglutenous indica type. Therefore the Japanese Government endeavors to import as much of the japonica type as possible from various countries. Recent figures are indicated in the table below:

Source Country	1954 Imports (tons)	1955 Imports (tons)
Japonica-type rice		
Formosa	6,400	16,600
China	8,100	14,300
United States (Calif.)	6,700	10,300
Spain	3,000	8,900
Italy	1,000	8,800
Egypt	....	4,700
Uruguay	1,000	1,700
Australia	....	700
Indica-type rice		
Burma	27,300	31,700
Thailand	31,600	19,900
United States (South)	11,700	11,300
Iran	1,300	....

Wheat. Because of unfavorable environmental conditions in Japan, its wheat is not of suitable quality for bread-baking, although it is satisfactory for making the Japanese type of noodles. Wheats of good quality, therefore, must be imported. About 50% of the wheat is processed into noodles; 40% is used for bread, and 10% for other purposes. Imports for two recent years were as follows:

Source Country	Wheat Imports: 1954 (tons)	Wheat Imports: 1955 (tons)
United States	121,100	109,600
Canada	75,200	87,500
Australia	....	31,700
Argentina	14,700	4,300

Barley. Used mainly as feed in other countries, barley here is processed skillfully into food, the grains being milled and rolled mechanically and mixed with rice in

cooking. Barley alone, however, is seldom used. To supplement its production in Japan, the following amounts have been imported recently:

Source Country	*Barley Imports* 1954	1955
	tons	*tons*
United States	31,700	34,100
Canada	6,600	17,500
Australia	15,200	20,800

Imports of cereals from abroad, especially wheat, have greatly increased since the war. Compared with prewar amounts, consumption of wheat and barley has increased remarkably as shown in the table below:

Year	*Consumption per Head per Day* Rice	Wheat	Barley
	g.	g.	g.
1934–38 average	369	24	12
1949	295	71	29
1953	282	73	30
1954	286	74	29

M. Uemura
Corresponding Editor

A.A.C.C.

LOCAL SECTIONS

Pioneer Section's program, August 16 and 17, included a Friday evening social gathering with San Francisco pictures shown, and a Saturday session until mid-afternoon. A lifetime award was presented to John Giertz. Rowland J. Clark spoke on "Pioneering," and a report of the San Francisco meeting was made vivid with more pictures in color, by Charles Sullivan and John Giertz. Ralph Potts opened and moderated a crop reporting panel discussion, his subject being "New crop farinograph curves." The parley continued with "Analytical characteristics relative to protein, ash, and moisture," Lawrence Iliff; "Sedimentation and viscosity," Eldon Smurr; "Malting requirements," John Giertz; "Oxidation-bleaching requirements," James M. Doty; "Extensograph and amylograph," George Schiller; "Baking characteristics of 1957 crop," Lester Fisher; and "Quality report of 1957 Nebraska wheat crop," Howard Becker.

The afternoon program presented C. W. Pence, speaking on "Wheat quality in Kansas," and J. O. Hibbard, "Aeration and fumigation of elevator bins."

• • • •

August 2 and 3 were meeting dates of Lone Star Section in Dallas. Friday evening sociability preceded Saturday's session, which opened with the business meeting followed by a report by the Crop Reporting Committee and a round-table discussion of the new wheat crop. After a group luncheon, "Experimental findings on wheat varieties and strains in 1957" were discussed by I. M. Atkins and Paschall Scottino, and C. F. Buck concluded the program with "Remarks on unusual crops of the past."

• • • •

The list of Pacific Northwest Section committees, with their chairmen appointed for 1957-58, reported in PNS July Newsletter, reflects plenty of activity and lively interests on the part of the section members; Membership

—Art King; Special Awards — Floyd Claypool; Commercial Scale Milling and Baking — Martin Wise; Crop Survey — J. W. Montzheimer; Pacific Northwest Grain Storage Sanitation — E. P. Walker; Representative to Agronomy Advisory Board — Don Colpitts; Board of Pacific Northwest Crop Improvement Association — Joe DeHaan, W. L. Haley; Representative to Western Wheat Quality Laboratory — Don Sundberg.

FLOUR MILLING

HOW HARD RED WINTER WHEAT WAS INTRODUCED INTO NORTH-CENTRAL KANSAS

In 1763 a group of Roman Catholic Germans accepted the invitation of the Great Catherine of Russia to turn the lower Volga district into the grain bin of her empire. Her promise of freedom from military service was attractive. However, the Czars who followed the Czarina gradually revoked all privileges, and after 100 years there were burdensome taxes, obligations to serve in the armies, and the refusal of the right to worship as they chose. Many decided to emigrate again, to a country where they could keep their German culture, guarded so carefully during their temporary stay in Russia.

In 1874 five delegates, selected at a meeting of 3,000 colonists representing 104 colonies, at Herzog, Russia,

were sent to America to look for suitable land. They visited parts of Kansas and Nebraska and reported favorably. The big attraction was the arable land selling for $2.00 to $2.50 per acre. Encouraged by this report, many decided to go to America. In the spring of 1876 eighteen families from Herzog purchased land from the Kansas Pacific Railroad Company (now the Union Pacific) and started the town of Herzog, near Fort Hays, Kansas. A few bought land or took homesteads immediately on arrival. Others worked on the railroad or for other farmers until they, too, could homestead, buy stock, and build a sod house. Owning land was a passion with these peasant people.

The colonists had brought with them hard red winter wheat which they hoped to raise in Kansas. In March 1877 every serviceable animal in the colony was yoked to a plow. That spring each family planted an average of 25 acres of Turkey wheat. In May, following an old custom, the colonists held a three-day festival to ensure a good harvest. The entire population, dressed in holiday costumes, turned out at daybreak and a procession led by the priest and head men of the village marched around every field of grain. They chanted of the Glory of God and beseeched Him to preserve the growing crop, destroy the insects, and finally to mature the grain, allow a bountiful harvest, and furnish a high-priced market. There was a good harvest and immediately the German-Russians started breaking ground for a bigger crop the next year. This reaction has continued, with the result that Kansas is the most important wheat-producing state in the Union.

The colony of Herzog grew steadily. Lured by enthusiastic reports to friends and relatives in Russia, a group of 286 persons, mostly from Herzog, Russia, arrived on August 3, 1876. Immigration in smaller groups continued until the beginning of World War I.

When the colonists arrived in Ellis County, there were no Catholic churches near by. However, a large wooden cross was erected about which the people gathered for devotions on Sundays and holidays. Divine services were held first in the home of one of the settlers. Progressively larger churches then were built to accommodate the congregation. The present church was built between 1908 and 1911, using largely hand labor. The resulting towering mass of brown natural sandstone, topped by two lofty towers, can be seen half a county away. St. Fidelis is one of the biggest churches in Kansas and its architecture is striking because of the flat land that surrounds it. It is a remarkable monument to the faith, strength, and determination of the pioneer builders.

The town of Herzog, settled by the German-Russians, and the nearby town of Victoria, settled by the English, were incorporated in 1913. Thus, the present town of Victoria with its church known to travelers as "The Cathedral of the Plains" marks the scene of the introduction of high-quality hard red winter wheat into North-Central Kansas.

BYRON S. MILLER

BOOK reviews

Modern Cereal Chemistry, by D. W. Kent-Jones and A. J. Amos. ix+817 pp. Northern Publishing Co., Ltd., Liverpool, England, 1957. Price, $15.25. Reviewed by C. H. BAILEY, University of Minnesota.

During the past third of a century this book has appeared in five successive editions, and has approximately trebled in size. The expansion in volume of material included in this fifth edition, as compared with the first edition published in 1924, is more or less in harmony with the increase in detailed knowledge of cereals and cereal technology that has evolved during that period of time. The authors have covered a vast and very comprehensive field indeed. Thus they present in considerable detail the most acceptable and significant data concerning the composition of the cereals; the technology of cereal processing, with particular emphasis on wheat milling and bread baking; the nutritive value of cereals and cereal products for humans and livestock, including a consideration of appropriate supplementation with vitamins, minerals, and antibiotics; insects infesting cereals and cereal products; and methods of testing and analysis. Naturally enough, in Chapters VII and IX dealing with milling and baking, British practices receive particular emphasis, although American and other processes are not overlooked. Continuous dough-making processes are not presented in any detail, however, although they are attracting no little attention in America at this time.

In expanding both scope and detail of this vast subject-matter area the two authors have utilized the services of numerous co-authors who have either written or edited the text of certain special sections. This is a logical procedure, since no two individuals can be completely conversant with all the technical areas covered in such a book. Moreover, such editorial practices doubtless resulted in the inclusion of many significant details that might otherwise have been omitted. Certain processes and instruments that are attracting attention in recent times have not been discussed fully, as, for example, rice enrichment, or the Neo-Laborograph for physical dough testing, but in general the book contains a vast amount of useful material, and an orderly presentation of applications. The authors have, in many instances, ap-

praised the adequacy of specific researches to which reference is made, and the degree and manner in which they may find application in the testing and usage of cereals and cereal products in industry and in the nutrition of man and animals. Thus they render a very substantial service to those who are concerned with the cereal industries and related fields by presenting a large volume of material, logically arranged, and well analyzed as to significance and application.

■■■■■■■■■

Dictionary of Dietetics, by Rhoda Ellis, 152 pp. Philosophical Library, New York, N. Y., 1956. Price, $6.00. Reviewed by HELEN L. PILCHER, University of Minnesota

According to the preface in this dictionary, the author "has attempted to collate and include the latest terms and references related to diet and diet therapy as well as some of the old standbys." The reviewer was disappointed in this reference book, which might have been a valuable addition to the literature concerned with diet and diet therapy. The preface points out that the subject matter is dynamic and therefore omissions or misstatements reflect the "rapid progress of tomorrow." Such errors, however, as "*Carbohydrate, Total by Difference*: subtract the percent of fat and protein from the total percent of inorganic matter"; "*Casein*: a nucleoprotein derived from milk"; or "*Adenylic Acid*: a decomposition product of adenine found also in the thymus gland" reflect a failure to accurately describe or define the terms no matter what the reasons. Other errors of a similar nature appear and are true errors regardless of the reader for whom they are intended. Many important items and new terms are included and are adequately described, but because of the aforementioned inaccuracies this book will probably have limited use by technical libraries and professional people.

In many instances the author, after describing the term, has given additional descriptive remarks which fail to add to the understanding and interpretation because often they are nonscientific, cumbersome, and sometimes even irrelevant. Many professional people will object to this style of presentation.

The print is easy to read, but the paper is of rather poor quality. The alphabetized terms are set out in bold black print and, although an index is lacking, a key word at the top of each page makes reference-finding easy. The use of more cross references would improve it.

The cost of the dictionary exceeds its probable usefulness.

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Advances in Agronomy, Vol. VIII, edited by A. G. Norman. xi+423 pp. Academic Press, Inc., New York, 1956. Price, $8.80. Reviewed by JOHN M. MacGREGOR, University of Minnesota.

As in the previous seven volumes in this series, contributing authors have competently reviewed several different areas in the field of soils and agronomy. The entire volume is a definite contribution to the available literature.

The use of anhydrous ammonia as a nitrogenous fertilizer is discussed by W. B. Andrews, who is generally regarded as the first investigator to recognize the possibilities of direct application of gaseous ammonia to the soil. The effect of this form of nitrogen on plant growth and the problems of distribution and application are covered at some length. A. J. Anderson considers the trace element molybdenum as a fertilizer as to field occurrence, nature, detection and correction of deficiencies, and the factors affecting the crop response to its application.

Field crop production and soil management in the Pacific Northwest are interestingly discussed by H. B. Cheney, W. H. Foote, E. G. Knox, and H. H. Rampton. Characteristics of the tri-state region (Idaho, Oregon, and Washington), soil resources, management, and crops of the area are outlined. J. E. Dawson briefly reviews the complicated subject of organic soils. This chapter could well be expanded for both interest and effectiveness.

Determining lime and fertilizer requirements of soils by chemical methods including calibration, sampling, chemical procedures, interpretation, recommendations, and future trends are thoroughly considered by J. W. Fitts and W. L. Nelson. Mineral nutrition of corn in relation to its growth and culture is well considered by L. B. Nelson in one of the most engaging chapters of the volume.

D. C. Smith reviews progress in the breeding of grasses since 1889 when the first grass-breeding program was initiated. One of these grasses, tall fescue, which is now important in many sections of the United States, is considered in much greater detail by J. R. Cowan. Winter hardiness of crop plants and the problems of evaluation are well presented by S. T. Dexter.

In general, each of the nine contributing articles comprising the volume are well documented, organized, and written. As usual, the editing by A. G. Norman is excellent.

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Laboratory Glassblowing, first American edition, by L. M. Parr and C. A. Handley, 154 pp. Chemical Publishing Co, New York, 1957. Price, $4.00. Reviewed by DALE R. SMITH, Geo. T. Walker Co.

A large portion of this small book, first published in England, is devoted to the basic equipment and skills required for elementary glassblowing, while the final chapters treat of such advanced techniques as the fabrication, drilling, and grinding of stopcocks. The authors have done a fine job of clear and logical presentation of their subject. All references are to British equipment and materials, thus belying the claim that it is an American edition.

Glassblowing is an art that is seldom practiced in modern industrial laboratories. The wide selections of glassware now offered and, in many cases, the availability of a professional glassblower for repairs and fabrication of special pieces usually free laboratory personnel from glassblowing responsibilities.

Twenty-five years ago this book would have been an asset to every laboratory using any quantity of glassware; today it has less value unless one intends to do glassblowing as a hobby.

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"Experiments in Biochemical Research Techniques" by Robert W. Cowgill and Arthur B. Pardee (Wiley, New York, June 1957, $3.50; 189 pp.) makes available the advanced methods used by today's biochemists through a series of 37 organized experiments.

People, Products, Patter

• • • People

Buell W. Beadle, from Southwest Research Institute, San Antonio, becomes manager of chemistry division, Midwest Research Institute, Kansas City, Mo.

Officers elected by Nebraska Bakery Production Club, Omaha, for the coming year: **Edward F. Cvejdlik,** pres., succeeds **John Roddy; Ralph Timperly,** pres.-elect; **Raymond Zaccardi** and **J. M. Doty,** first and second vp; and **Ed Rosse,** sec.-treas.

Herman Giesecke, product manager, Yeast Plant No. 2, Anheuser-Busch, Inc., Old Bridge, N. J., died suddenly in Cologne, Germany. He suffered a heart attack during the first week of his proposed month-long trip – first visit in 30 years to his native land. He had been employed by Anheuser-Busch during his entire stay in the United States and, being the son of a European pioneer yeast manufacturer, his entire life had been spent in the yeast business. He had been a member of New York Section, A.A.C.C., for 10 years.

C. G. Harrel, director of new products ideas department at Pillsbury Mills, elected president of Research and Development Associates Food and Container Institute.

John M. Harrison joins Sterwin Chemicals as Southwest representative, Dallas, calling on flour and feed mills, bakeries, and general food trade. From Bewley Mills, Inc., Fort Worth.

Norman W. Kempf, manager of chocolate development, Walter Baker Division of General Foods, receives the Stroud Jordan Award of the American Association of Candy Technologists.

David H. Knutson recently joined products research staff of **food products division,** Procter & Gamble Co.

Edward E. Langenau elected vp of Fritzsche Bros., Inc. He is director of the analytical laboratory and secretary of the research committee of the firm.

Richard M. Lawrence named research project analyst of A. E. Staley Mfg. Co., Decatur, Ill.

Lloyd C. Mitchell, research chemist of the Food & Drug Administration, named to receive the first Harvey W. Wiley Award of the A.O.A.C. Mitchell has developed methods of analysis for spices, cereals, dairy products, and eggs.

Elmer Modeer, lab director and nutritionist at Staley Milling Co., named chairman of American Feed Manufacturers' Association nutrition council.

Werner Motzel joins research and development staff of food products division, Procter & Gamble Co.

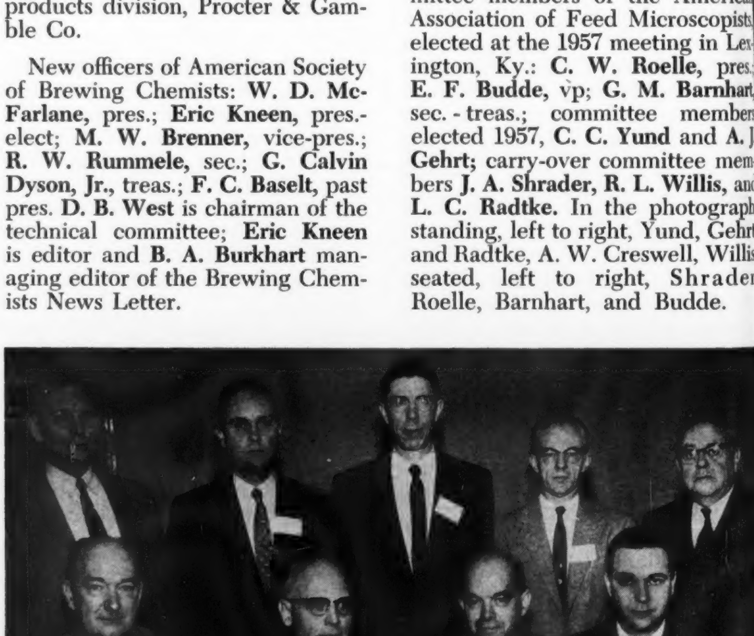
New officers of American Society of Brewing Chemists: **W. D. McFarlane,** pres.; **Eric Kneen,** pres.-elect; **M. W. Brenner,** vice-pres.; **R. W. Rummele,** sec.; **G. Calvin Dyson, Jr.,** treas.; **F. C. Baselt,** past pres. **D. B. West** is chairman of the technical committee; **Eric Kneen** is editor and **B. A. Burkhart** managing editor of the Brewing Chemists News Letter.

Ludvig Reimers is retiring after 35½ years' service with General Mills' Sperry Operations, San Francisco. He and Mrs. Reimers will travel in the fall to Australia and New Zealand, making stops at Tahiti, Samoa, Fiji, and Honolulu.

Lloyd Regier joins development staff of food products division, Procter & Gamble Co.

Frederick P. Siebel, Sr., chairman of the board of the J. E. Siebel Sons' Co. and the Siebel Institute of Technology, Chicago, died on June 17 at the age of 84. He was the first to successfully establish courses in baking technology, his first resident course beginning in 1916. In 1919 he inaugurated the first correspondence course in baking, and a year later introduced resident courses in cake and pastry baking. Over the years the Siebel Institute has trained more than 10,000 students. In 1917 Dr. Siebel authored the first edition of "Siebel's Manual for Bakers and Millers" which long remained a standard work in its field and went through several subsequent editions.

New officers and executive committee members of the American Association of Feed Microscopists elected at the 1957 meeting in Lexington, Ky.: **C. W. Roelle,** pres.; **E. F. Budde,** vp; **G. M. Barnhart,** sec.-treas.; committee members elected 1957, **C. C. Yund** and **A. J. Gehrt;** carry-over committee members **J. A. Shrader, R. L. Willis,** and **L. C. Radtke.** In the photograph, standing, left to right, Yund, Gehrt, and Radtke, A. W. Creswell, Willis; seated, left to right, Shrader, Roelle, Barnhart, and Budde.



• • • Products

A new low-priced vapor phase analyzer for gas chromatography, which is said to perform virtually all the operations of more costly instruments, is announced by Central Scientific Co. Write to them at 1700 Irving Park Road, Chicago 13, Ill.

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Specialized, heavy-duty laboratory fixtures for gas, air, vacuum, and tap and distilled water, including calibrated needle valves for nitrogen, hydrogen, argon, and oxygen for pressures up to 1000 lbs., are shown in Labmaster Catalog PF-57. Sent on request (company letterhead) to Laboratory Furniture Co., Inc., Old Country Road, Mineola, L. I., N. Y.

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Pyrex brand Accu-red pipets feature saving in cost, accurate reading, extra strength, and more advantages; described in Supplement No. 2 to Catalog LP36 of Corning Glass Works. Vapor-Temp controlled Relative humidity chamber described in Bulletin 5525-A. Both from Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago 22.

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Sartorius projection balances; Selecta speed balances; "Microtor" torsion balance; exposure meters for photomicrography; low-power micro manipulators are distributed by C. A. Brinkmann & Co., 378-380 Great Neck Road, Great Neck, L. I., N. Y., who will send recently published literature on request.

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A new Scientific Industries Ultra-Buret, Model 200, for use where a large number of titrations are being run with the same reagent, offers a combination of accuracy at low ultra micro readings, high capacity, speed of operation, and durable construction. Mechanical control and engraved scales replace stopcock control and meniscus readings. Write for brochure, Scientific Industries, Inc., 15 Park St., Springfield 5, Mass.

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Two brochures offered by Aloe Scientific: "New and recent devices for laboratories of chemistry and biology" includes items such as Beckman instruments and accessories; Runco Vacuum Evaporators; the new Cahn Electrobalance for analytical weighing; recent High-Speed Centrifuges. "Laboratory Medicine" illustrates new laboratory instruments and consolidates information on recent apparatus. Lower prices are offered on some standard glasware items. For either or both: Aloe Scientific, 5655 Kingsbury St., St. Louis 12, Mo.

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Problems of pumping and metering small flows of slurries, abrasives, etc., may find solution in the "Kinetic-Clamp"—a machine which applies pressure externally on a flexible tube, thereby transmitting energy to contained liquids to produce a controlled flow. Corneil Associates will send a full description and will recommend a solution to special pumping and metering problems. Ask for Technical Guide No. 10; address R.R. No. 1, Thorold, Ontario.

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Quantitative determinations of moisture content in cereals, syrups, soap, and other products are made by a new Schlumberger high-speed nuclear magnetic resonance moisture analyzer, Model 104. Time required is from 30 seconds to 4 minutes as opposed to 4 hours required by oven or similar methods. A permanent, legally valid chart recording of the analysis is made. Technical information from Schlumberger Well Surveying Corp., Ridgefield, Conn.

. . . Patter

A new research and development laboratory for the electrochemicals department of E. I. Du Pont de Nemours & Co., Inc., will be constructed at Niagara Falls, it was announced by Campbell Robertson, laboratory manager. The building will offer added facilities for the investigation of lysine, which is being used to raise the quality of protein in bread and other wheat foods. Construction will begin shortly and the laboratory is expected to be ready by fall, 1958.

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"Grain Sanitation Program, Revised April 1957, of the Food and Drug Administration . . ." is the curtailed title of an excellent pamphlet directed to "all who are concerned with storage, shipment, and processing of the 'staff of life'", particularly the farmer and the elevator operator. An explanation of the administration's Clean Wheat Program, vigorous measures for keeping wheat free from rodents and insects, and directions for examining grain for damage from these pests are clearly set out with conciseness and brevity, and well illustrated. The U. S. Department of Health, Education, and Welfare, Food and Drug Administration, Washington 25, D. C., offers this and additional printed matter listed in the pamphlet itself.

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A symposium on microscopic-analytical methods for product control in the food and drug industries will feature the 71st annual meeting of the Association of Official Agricultural Chemists in Washington on October 15, 1957. Sanitation problems resulting from the presence of insects and rodents, raw materials control, and laboratory testing will be discussed formally in a series of papers and informally in scheduled question-and-answer periods.

Kenton L. Harris, Associate Chief of the Division of Microbiology, Food and Drug Administration, will serve as general chairman of the symposium. Ten papers are planned to provide up-to-date information on plant sanitation practices and laboratory methods. They will present a range of viewpoints from government, industry, and industry consultants. Programs will be distributed about October 1, 1957, and copies may be obtained by writing to Dr. William Horwitz, Secretary-Treasurer, A.O.A.C., Box 540, Benjamin Franklin Station, Washington 4, D.C.

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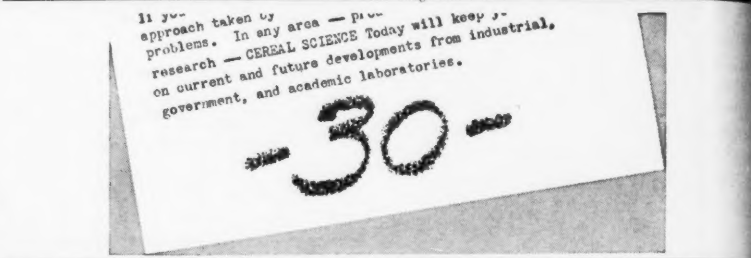
Delegates of the International Federation of Agricultural Producers, meeting at Purdue University, reelected President John Andrew of New Zealand; said surplus problems are worst now for wheat, maize, cotton, some dairy products, and rice; reaffirmed their belief in the FAO set of principles for disposal of surpluses and urged new strength for the subcommittee handling it. October 1958 and Brussels were chosen as the time and place of the next meeting.



MARGARET P. HILLIGAN

It is with the deepest personal regret that we relay the news of the death of Miss Margaret P. Hilligan, Head of Information Services, Research Laboratories, General Mills, Inc. Miss Hilligan died on July 27th after being away from her desk since last December.

Miss Hilligan was associated with General Mills for 12 years. She was a graduate chemist and used her scientific training to excellent advantage in her library work. She gave freely of her time to all who asked and for this reason was extremely active in a number of professional organizations such as the American Chemical Society, the Special Libraries Association, and the AACC. Her contributions to the latter group were especially numerous and always invaluable.

Subject classifications for the third decennial index for CEREAL CHEMISTRY were set up by Margaret to standardize the journal's indexing procedures. She either indexed or supervised the indexing of CEREAL CHEMISTRY for the past 11 years and was responsible for the indices in the AACC's Monograph No. 2 and the 6th edition of Cereal Laboratory Methods. Her journalistic talents were also used by the Special Libraries Association when she edited their first monograph, "Libraries for Research and Industry."

Her special efforts in behalf of the SLA were so many that the organization conferred upon her the Science-Technology Division Award for "Contributions to Librarianship in Science and Technology" at is Annual Meeting in Boston early this year. The Margaret Hilligan Memorial Fund has been started by her friends and fellow librarians to aid those seeking special training as a technical librarian. This was a cause long championed by Margaret during her career at General Mills.

It is difficult for this writer to realize that his friend and associate will no longer be as near as the telephone to give advice and guidance. But Margaret's wisdom and great understanding will be remembered and the standards she set will be a challenge for the future.

NEW AACC COMMITTEE

For the past year it has been quite evident to the people selling advertising space in the AACC journals that the role of the cereal chemist is often misunderstood. Advertising agencies and advertising departments in various companies among the allied trades people sometimes overlook the chemist as a potential sales contact. Their thinking apparently is that production uses the raw material so production is the only department other than purchasing worth contacting. We are happy that not all allied trades people feel this way as evidenced by the present advertising support given the AACC journals.

New products are not developed in production *but* in the laboratory. *New raw materials* are not first tried out in production *but* in the laboratory. It's the chemist that has to be sold first on the merits of a new material before it is given further consideration.

Slowly but surely technical salesmen are getting this story back to their sales and advertising departments. To help speed this process, the AACC has established an advertising committee whose job will be to point out to suppliers that the most logical place to push a new product is in the laboratory. It follows that the best media in which to reach the cereal chemist is in his own publications, CEREAL CHEMISTRY and CEREAL SCIENCE TODAY.

The advertising committee is composed of the following members: Arlee A. Andre, Zenas Block, David L. Carpenter, Meade C. Harris, Ralph Lakamp, Lawrence F. Marnett, Elmer Modeer, J. Robert Roach, and Oscar Skovholt.

R.J.T.

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